THE POTENTIAL FOR ENERGY CONSERVATION AND FUELWOOD SUBSTITUTION IN REMOTE COMMUNITIES IN NEWFOUNDLAND AND LABRADOR

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With a contribution from:

Remote Community Demonstration Program
of Energy, Mines and Resources Canada

March 1985

RCDP/PDCE-70

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FORWARD AND ACKNOWLEDGEMENTS

The following report on the potential for energy conservation and fuelwood substitution in remote communities in Newfoundland and Labrador was prepared by IDP Consultants Limited, who acted as principal contractor, and BFL Consultants Limited and Research Associates, who acted as subcontractors. In consideration of the support and assistance given to the consultants in completing this study, we gratefully acknowledge the following groups:

Newfoundland and Labrador Rural Development Council

Energy, Mines and Resources Canada

Canadian Forestry Service

Statistics Canada

Provincial Department of Forest Resources and Lands

Provincial Department of Mines and Energy

Last, but by no means least, the consultants would like to thank those individuals who participated in the survey, and who, by their co-operation, made this study possible.

1.0 EXECUTIVE SUMMARY

The Remote Community Demonstration Program (RCDP) is a federal government initiative designed to promote the awareness and adoption of alternate energy and energy conservation technologies in remote communities. An overview study for Newfoundland and Labrador was prepared for the Newfoundland office of Energy, Mines and Resources Canada during the summer of 1983, and provided socio-economic profiles and technical assessments of the likely alternatives to oil for both space heating and electrical generation for eligible communities. As a result of this study, a number of gaps in the information base required to administer the RCDP Program in Newfoundland and Labrador were identified. Particularly significant was the inadequacy of the current data base to evaluate the potential for energy conservation and fuelwood substitution in remote communities of Newfoundland and Labrador. As a consequence, a proposal was submitted to the Newfoundland and Labrador Rural Development Council to undertake a study to identify and analyze the technical and economic factors affecting the potential for energy conservation and fuelwood substitution in communities throughout Newfoundland and Labrador eligible for the RCDP Program.

The present study had two major independent but interrelated components. The first component was designed to estimate the potential for energy conservation for the four regions defined as part of the overview study referenced above - Labrador, Northern, Central and Southern. The second component was designed to consolidate the existing fuelwood inventory base for each eligible community and estimate the potential for fuelwood substitution.

In order to estimate the potential for energy conservation it was determined that a representative sample survey of 400 households, 100 for each of the four regions, was required. The questionnaire contained information on housing characteristics, e.g. age, tenure, type, structure and size; socio-economic characteristics, e.g. age, income, education, employment status; energy consumption patterns and costs, e.g. primary and secondary heating sources; and energy conservation characteristics, e.g. levels and types of insulation; and related conservation variables, e.g. window glazing and weatherstripping. In order to utilize the information collected by the survey to estimate conservation potential, a methodology was developed which compared existing energy conservation practices in remote communities to the retrofit standards recommended by CMHC for existing residential buildings. This methodology essentially enabled the analyst to measure the existing heat loss from a home given present energy conservation practices, and to estimate the potential net reduction in heat loss which would occur should CMHC standards be implemented. Furthermore, given

current energy consumption patterns and costs, the potential for energy conservation was translated into estimated energy and dollar savings.

The principal survey findings can be summarized as follows:

- The majority of homes in remote communities are owner-occupied, single detached dwellings that are either bungalows or two-storeys built after 1950.

- The majority of respondents in remote communities use wood as the principal heating fuel, i.e. 53%. Regionally this breaks down as follows: Labrador 64%; Northern - 56%; Central - 62%; and Southern - 29%.

- Ninety-four percent of respondents do not use any form of supplementary heating.

- Ninety-one percent of the respondents who use wood as their main heating source cut their own wood, and 91% of these obtain it within 20 miles of their homes.

- The estimated average annual consumption of oil for people using oil as the main heating source is 956 gallons. Regionally, this breaks down as follows: Labrador - 1181 gallons; Northern - 1026 gallons; Central - 1036 gallons; and Southern - 767 gallons.

- The estimated average annual consumption of fuelwood for people using wood as the main heating source is 11.1 cords. Regionally this breaks down as follows: Labrador - 16.2 cords; Northern - 9.3 cords; Central - 8.8 cords; and Southern - 8.2 cords.

- The socio-economic characteristics of respondents can be summarized as follows:

  - Gender - 55% male, 45% female.
  - Age - 59% between 25 and 44.
  - Occupation - 28% in primary, 38% in other, and 34% not in labour force.
  - Employment Status - 48% of respondents in labour force unemployed an average 5.5 months in past 12 months.
  - Education - 43% completed grade eight or less.
  - Income - Average total household income estimated to be $21,219.

- Conservation potential, i.e. the difference between existing building heat loss based on present energy conservation standards and the reductions in heat loss possible by upgrading to CMHC standards, is 72% for all

regions. Regionally, this breaks down as follows: Labrador - 72%; Northern - 70%; Central - 73%; and Southern - 71%. Major areas for improvement are the ground floor and the attic and this is consistent throughout all regions.

- The estimated annual energy savings per household associated with this conservation potential is 136 million BTU's. Regionally, this breaks down as follows: Labrador - 186; Northern - 128; Central - 131; and Southern - 96.

- The estimated annual cost savings per household associated with this conservation potential is $899. Regionally, this breaks down as follows: Labrador - $1072; Northern - $858; Central $830; and Southern - $839.

In order to consolidate the existing fuelwood inventory data base as it pertains to remote communities, contact was made with the Provincial Department of Forest Resources and Lands to obtain the required mapping information. Throughout the process of collecting this information a number of important findings were made. Inventory mapping is completed for 18 management areas on the Island of Newfoundland; however, some of this information is dated from early 1960 and 1970 work. Little information is available on non-commercial timber stands and there is no detailed information on the percentage of inventoried forest which is now dead or dying as a result of the spruce budworm infestation. To further complicate the task of preparing fuelwood inventory calculations for the 77 communities identified under the RCDP Program, it has been determined that no forest inventory maps are completed or are planned for the entire south coast of the island portion of the province, and that only preliminary information is available for certain portions of Labrador.

Given the limitations on data availability it was only possible to do an analysis for eleven load centres encompassing 37 communities. This represents 48% of the total 77 communities identified as eligible under the RCDP Program.

In conducting the analysis of fuelwood availability a number of basic steps were followed. Using the 1:30,000 scale inventory maps for the island and 1:20,000 scale maps for Labrador, a detailed listing of the accessible timber stands was compiled. The stands selected were based on the criteria of using a 30 km radius envelope centred at the community under consideration. Timber stands 1.5 km on either side of roadways and waterways or within 1.5 km of the

coastlines were considered to be accessible to the type of equipment normally used by individuals harvesting fuelwood. The area method was used to determine the allowable annual cut in hectares for each envelope.

For the community envelopes in the Newfoundland regions, a weighted average age was determined by multiplying the area of an age class by the age class midpoint. The average normal age as used by the Department of Forest Resources and Lands is 35 years. The allowable normal annual cut is found by dividing the total area regardless of age by 70 years, with the initial 20-year allowable cut being that found by multiplying the allowable normal annual cut by the ratio of the weighted average age to the average normal age.

In Labrador the age of the forest stands is not readily available. Therefore the allowable annual cut was found by dividing the total accessible area by 70 years.

Information on the average volume yields of forest areas by management unit was obtained. The data is available on computer printouts giving average volume yield per hectare by stand type for each management unit.

The areas by stand type obtained previously were multiplied by the appropriate volume yield and average yield obtained for each species and community envelope.

Of the eleven load centres under consideration, six have their reference community's envelope overlapped by other communities. In other words, the area of the 30 km radius envelope falls within areas that would come under pressure to supply fuelwood to other communities, some of which may be within the load centre, while others are outside.

In order to determine the significance of the sustainable yield from each of the envelopes, and the overlap influence, other information had to be determined, such as the percentage of current woodburning dwellings and the percent of the total heat currently being provided by wood for these dwellings.

The detailed calculations resulting from the above methodology enable the analyst to arrive at the Estimated Sustainable Percentage Increase above the current estimated levels of consumption of the eleven load centres under consideration.

The estimated annual sustainable percentage increase in fuelwood usage can be summarized by load centre as follows:

Cartwright	759%
Mud Lake	9589%

Black Tickle	94%
Postville	943%
Port Hope Simpson	1925%
Harbour Deep	179%
Roddickton	77%
St. Anthony	3%
Fogo Island	-76%
Little Bay Islands	163%
St. Brendans	154%

As is evident from the above information, only one load centre, i.e. Fogo Island, appears to be seriously overtaxing the resource base available. While St. Anthony is also approaching the limits of increased usage of the resource base, the other nine load centres have more than adequate fuelwood to satisfy present fuelwood consumption patterns.

LE POTENTIEL D'ÉCONOMIE D'ÉNERGIE ET D'IMPLANTATION DU BOIS COMME COMBUSTIBLE DE CHAUFFAGE DANS LES COLLECTIVITÉS ÉLOIGNÉES DE TERRE-NEUVE ET DU LABRADOR

Résumé

Le Programme de démonstration dans les collectivités éloignées (PDCE) mis sur pied par le gouvernement fédéral a comme objectif de faire connaître et adopter les technologies relatives aux énergies de remplacement du pétrole et aux économies d'énergie dans les collectivités éloignées. Au cours de l'été 1983, une étude globale de la situation existant à Terre-Neuve et au Labrador a été réalisée pour le bureau d'Énergie, Mines et Ressources Canada à Terre-Neuve. Cette étude présente des profils socio-économiques et fournit une évaluation technique des sources probables de remplacement du pétrole, en ce qui concerne autant le chauffage des habitations que la production d'électricité dans les collectivités admissibles. Cette étude a permis de préciser un certain nombre de lacunes au titre de l'information existante, qu'il faudra combler pour être en mesure d'appliquer le programme PDCE à Terre-Neuve et au Labrador. Il ressort clairement de cette étude que le capital-données actuel ne permet pas d'évaluer le potentiel d'économie d'énergie et d'implantation du bois comme combustible de chauffage dans les collectivités éloignées de Terre-Neuve et du Labrador. Par conséquent, il a été proposé à la Newfoundland and Labrador Rural Development Council que soit réalisée une étude pour déterminer et analyser les facteurs techniques et économiques qui influent sur le potentiel d'économie d'énergie et d'implantation du bois comme combustible dans les collectivités de Terre-Neuve et du Labrador admissibles au programme PDCE.

La présente étude a deux volets importants qui sont indépendants mais intimement liés. Le premier consiste à évaluer le potentiel d'économie d'énergie des quatre régions définies dans le cadre de l'étude globale susmentionnée: le Labrador, le Nord, le Centre et le Sud. Le second consiste à réunir toute l'information existant sur le bois de chauffage de chaque collectivité admissible et à évaluer les possibilités en matière d'implantation du bois comme combustible.

Afin que soit évalué le potentiel d'économie, il a été déterminé qu'une enquête par échantillonnage représentatif de 400 ménages, soit 100 par région, s'imposait. Un questionnaire a été conçu de façon à ce qu'il permette d'obtenir des renseignements sur les caractéristiques du logement, c'est-à-dire âge, bail, type, structure et dimensions; sur les caractéristiques socio-économiques, c'est-à-dire, âge, revenu, éducation et situation relative à l'emploi; sur les modes de consommation d'énergie et les coûts associés, c'est-à-dire sources de chauffage principales et secondaires; sur les caractéristiques relatives aux économies d'énergie,

c'est-à-dire niveaux et types d'isolation; enfin, sur les moyens d'économie d'énergie connexes, c'est-à-dire vitrage des fenêtres et coupe-froid. Pour être en mesure d'utiliser les renseignements ainsi recueillis, une méthode permettant de comparer ce qui se fait actuellement dans le domaine dans les collectivités éloignées aux normes d'amélioration de l'isolation thermique recommandées par la SCHL en ce qui concerne les immeubles résidentiels déjà construits a été mise au point. Cette méthode a essentiellement permis à l'analyste de mesurer la perte de chaleur d'une maison donnée, compte tenu des moyens utilisés actuellement pour économiser l'énergie, et d'évaluer la réduction nette de perte de chaleur qui résulterait de l'application des normes de la SCHL. En outre, compte tenu des schémas et des coûts acutels de consommation d'énergie, le potentiel d'économie d'énergie a été exprimé en dollars et quantité d'énergie, estimatifs, économisés.

Les principales conclusions de l'enquête peuvent se résumer de la façon suivante:

- La majorité des maisons des collectivités éloignées sont occupées par le propriétaire; elles sont de type unifamiliale, à deux étages ou à deux niveaux, dont la construction remonte après 1950.

- La majorité des répondants des collectivités éloignées utilisent le bois comme principal moyen de chauffage, c.-à-dire 53 %. Par région, cela équivant à 64 % au Labrador; 56 % dans le Nord; 62 % dans le Centre; 29 % dans le Sud.

- Quatre-vingt-quatorze pour cent des répondants n'utilisent aucune autre forme de chauffage supplémentaire.

- Quatre-vingt-onze pour cent des répondants qui utilisent le bois comme principale source de chauffage, coupent leur propre bois, et 91 % d'entre eux l'obtiennent dans un rayon inférieur à 20 milles de leurs maisons.

- On évalue la consommation moyenne de mazout, dans les cas où il constitue la principale source de chaleur de chauffage à 956 gallons par année. Par région, cette consommation correspond à: 1 181 gallons au Labrador; 1 026 gallons dans le Nord; 1 036 gallons dans le Centre; 767 gallons dans le Sud.

- On évalue la consommation moyenne de bois de chauffage dans les cas où le bois constitue la principale source de chauffage à 11,1 cordes par année. Par région, on obtient la ventilation suivante: 16,2 cordes au Labrador; 9,3 cordes dans le Nord; 8,8 cordes dans le Centre; 8,2 cordes dans le Sud.

- Les caractéristiques socio-économiques des répondants peuvent se résumer de la façon suivante:
  - Sexe: 55 % d'hommes et 45 % de femmes.
  - Âge: 59 % se situent entre 25 et 44 ans.
  - Emploi: 28 % dans le secteur primaire, 38 % dans les autres secteurs et 34 % hors de la population active.
  - Situation relative à l'emploi: 48 % des répondants faisant partie de la population active ont été sans emploi pendant une moyenne de 5,5 mois au cours des 12 derniers mois.

- Scolarité: 43 % des répondants ont tout au plus terminé leur huitième année scolaire.
- Revenu: le revenu total moyen par ménage est évalué à 21 219 $.

- Le potentiel en matière d'économies d'énergie, c'est-à-dire la différence entre la perte de chaleur enregistrée par les maisons existantes d'après les moyens d'économie d'énergie utilisés actuellement et la perte moindre réalisable en se conformant aux normes de la SCHL, sont de 72 % pour l'ensemble des régions. Par région, cette différence se décompose comme suit: 72 % au Labrador; 70 % dans le Nord; 73 % dans le Centre; 71 % dans le Sud. Les parties de la maison qui nécessitent le plus d'amélioration, et ce dans toutes les régions, sont le rez-de-chaussée et le grenier.

- Les économies d'énergie annuelles par maison, en ce qui concerne ce potentiel d'économie d'énergie sont évaluées à 136 millions de B.T.U. Par région, cette quantité se décompose comme suit: Labrador, 186; le Nord, 128; le Centre, 131; le Sud, 96.

- On évalue les économies réalisées annuellement par maison relativement à ce potentiel d'économie d'énergie à 899 $. Par région, ce montant se décompose comme suit: Labrador, 1 072 $; le Nord, 858 $; le Centre, 830 $; le Sud, 839 $.

Pour compléter l'inventaire du bois de chauffage dont disposent les collectivités éloignées, des représentations ont été faites auprès du Department of Forest Resources and Lands de la province qui ont permis d'obtenir les renseignements cartographiques nécessaires. Au cours de l'étape de compilation des renseignements, un certain nombre de conclusions importantes ont pu être tirées. Ainsi les cartes d'inventaire touchant 18 zones d'aménagement de l'Île de Terre-Neuve existent, mais une partie des renseignements datent du début des années 60 et 70; il existe peu de renseignements sur les peuplements de bois d'oeuvre non commerciaux et très peu de détails sur le pourcentage de forêts répertoriées qui ont disparues ou qui sont en train de disparaître suite aux épidémies de la tordeuse des bourgeons d'épinette. Pour compliquer davantage l'inventaire de bois de chauffage des 77 collectivités identifiées dans le cadre du programme PDCE, aucune carte d'inventaire forestier de toute la côte sud de l'île, n'est terminée ni même prévue, et seuls quelques renseignements préliminaires sont disponibles pour certains secteurs du Labrador.

Compte tenu du manque de données disponibles, l'analyse n'a porté que sur 11 centres de chargement desservant 37 collectivités, ce qui représente 48 % des 77 collectivités jugées admissibles dans le cadre du programme PDCE.

Pour analyser le capital-bois de chauffage, un certain nombre d'étapes fondamentales ont été suivies. En se basant sur les cartes d'inventaire à 1/30 000, en ce qui concerne l'île et les cartes à 1/20 000, en ce qui concerne le Labrador, une liste détaillée des peuplements de bois d'oeuvre accessibles a d'abord été dressée. Les peuplements choisis devaient se trouver dans un rayon de 30 km autour de la collectivité en question, soit l'enveloppe. Les peuplements situés à 1,5 km de chaque côté des voies ferrées et des voies d'eau ou à au moins 1,5 km de la côte

ont été jugés accessibles au type de matériel habituellement utilisé pour la coupe du bois de chauffage. La méthode de détermination selon la superficie a été utilisée pour établir le nombre d'hectares annuels permis pour la coupe dans chaque enveloppe.

Pour ce qui est des enveloppes s'appliquant aux collectivités des régions de Terre-Neuve, un âge moyen pondéré a été calculé en multipliant la superficie d'une classe d'âge par la classe d'âge centrale. Le Department of Forest Resources and Lands utilise l'âge normal moyen de 35 ans. Par conséquent, la coupe normale permise par année se détermine en divisant la superficie totale, quel que soit l'âge, par 70 ans, la coupe permise initiale de 20 ans correspondant à la multiplication de la coupe normale permise par année par le rapport de l'âge moyen pondéré à l'âge moyen normal.

Au Labrador, l'âge des peuplements n'est pas facilement disponible. Par conséquent, la coupe annuelle permise a été établie en divisant la superficie totale accessible par 70 ans.

Des renseignements sur le rendement moyen (en volume) des superficies forestières par unité d'exploitation ont pu être obtenus. Les données sont disponibles sur imprimés d'ordinateur où l'on précise le rendement moyen (en volume) à l'hectare par type de peuplement, pour chaque unité d'exploitation.

La superficie de chaque type de peuplement obtenue précédemment a été multipliée par le rendement approprié (en volume) et par le rendement moyen obtenu pour chaque essence et enveloppe.

Six des onze centres de chargement à l'étude font partie d'une enveloppe qui recoupe l'enveloppe d'une autre collectivité. En d'autres termes, la zone couverte par l'enveloppe d'un rayon de 30 km chevauche des zones qui devraient fournir du bois de chauffage à d'autres collectivités dont certaines peuvent se situer à l'intérieur du centre de chargement tandis que d'autres peuvent se situer à l'extérieur.

Pour évaluer l'importance du rendement que peut maintenir chacune des enveloppes et l'influence des chevauchements, il a fallu obtenir d'autres renseignements, tels que le pourcentage des habitations qui utilisent le bois de chauffage ainsi que le pourcentage du chauffage total qui est fourni par le bois dans ces même habitations.

Cette méthode a permis d'obtenir des chiffres détaillés dont s'est servi l'analyste pour établir l'accroissement estimatif en pourcentage qui peut être maintenu par rapport aux niveaux actuels de consommation dans les onze centres de chargement à l'étude.

Cet accroissement de la consommation de bois de chauffage, par centre de chargement peut se décomposer comme suit:

Cartwright	759 %
Mud Lake	9 589 %
Black Tickle	94 %
Postville	943 %
Port Hope Simpson	1 925 %
Harbour Deep	179 %
Roddickton	77 %
St. Anthony	3 %
Fogo Island	-76 %
Little Bay Islands	163 %
St. Brendans	154 %

Comme l'indiquent les renseignements ci-dessus, un seul centre de chargement, c'est-à-dire Fogo Island, semble surtaxer de façon importante le capital-ressources disponibles. Bien que St. Anthony soit également sur le point d'atteindre ses limites de consommation relativement à son capital-ressources, les neuf autres centres de chargement possèdent plus de bois de chauffage qu'il n'en faut pour satisfaire aux modes de consommation actuels en bois de chauffage.

Cette étude a été exécutée par la Newfoundland and Labrador Rural Development Council, grâce à une contribution du Programme de démonstration dans les collectivités éloignées d'Énergie, Mines et Ressources Canada. La IDP Consultants Limited, de St. John's à Terre-Neuve a réalisé les travaux impliqués, en collaboration avec le BFL Consultants Limited, de St. John's, et la Research Associates, également de St. John's.

2.0 INTRODUCTION

Throughout Newfoundland and Labrador there are 39 diesel generating plants serving some 77 communities which are eligible for the RCDP Program. An overview study prepared by Brador Resource Management Limited and BFL Consultants Limited during the summer of 1983 provided socio-economic profiles and technical assessments of the likely alternatives to oil for both space heating and electrical generation for each of these eligible communities.

As a result of the overview study completed by those two firms, a number of gaps in the information base required to administer the RCDP Program in Newfoundland and Labrador were identified. Particularly significant was the inadequacy of the current data base to evaluate the potential for energy conservation and fuelwood substitution in remote communities of Newfoundland and Labrador.

As a consequence a proposal was submitted to the Newfoundland and Labrador Rural Development Council to undertake a study to identify and analyze the technical and economic factors affecting the potential for energy conservation and fuelwood substitution in communities throughout Newfoundland and Labrador eligible for the RCDP Program.

In completing the work required for this study the following study requirements had to be met:

- To review and evaluate the existing data base on energy conservation as it affects remote communities in Newfoundland and Labrador.
- To identify the data requirements and target group necessary to evaluate the potential for energy conservation in remote communities of Newfoundland and Labrador.
- To design and conduct a survey to capture the required data.
- To consolidate the existing fuelwood inventory information base.
- To develop the technical and economic criteria with which to evaluate the potential for energy conservation and fuelwood substitution in remote communities of Newfoundland and Labrador.

- To conduct an analysis of both the survey results and the fuelwood inventory information and prepare a report on the potential for energy conservation and fuelwood substitution for remote communities throughout Newfoundland and Labrador.

3.0 ENERGY CONSERVATION ANALYSIS

3.1 Methodology and Approach

3.1.1 Review Available Information

A review of existing data bases and publications on energy conservation in remote communities was conducted at the beginning of the study. Information from EMR programs as they relate to Newfoundland (CHIP, COSP, Enersave) indicates that the data available is not easily accessible for use, nor in a format which would enable it to be used in estimating energy conservation potential in RCDP communities. While other data bases, notably Statistics Canada, and publications, notably the RCDP Overview Study, provide general community profile type information, this data does not address the question of current energy conservation practices in households in remote communities. The information presently available was only useful in identifying the characteristics of the population to be surveyed, and in this regard was used to provide screening criteria in sample determination and selection and survey implementation. A representative and random sample of households in each of the four regions collecting data on the key housing, socio-economic and technical, i.e. energy conservation practices, characteristics of selected households was required in order to estimate energy conservation potential.

3.1.2 Survey Design and Implementation

In order to obtain information appropriate for estimating the potential for energy conservation it was necessary to design a survey questionnaire. The questionnaire was developed following a number of meetings between the consultants and EMR officials and the fourth draft of this document was used for data collection. The questionnaire contained information on housing characteristics, e.g. age, tenure, type, structure and size; socio-economic characteristics, e.g. age, income, education, employment status; energy consumption patterns and costs, e.g. primary and secondary heating sources; and energy conservation characteristics, e.g. levels and types of insulation; and related conservation variables, e.g. window glazing and weather-stripping.

The population under study comprised adults 18 years of age and older and resident in one of the four remote areas designated by the RCDP study. The four areas were defined as follows.

Labrador

Hopedale
Black Tickle
Cartwright
Charlottetown
Davis Inlet
Capstan Island
Forteau
L'Anse au Clair
Makkovik
Mary's Harbour
Lodge Bay
Mud Lake
Rigolet
Williams Harbour
L'Anse au Loup
Pinware
Red Bay
West St. Modeste
English Point
Fox Cove
L'Anse Amour
L'Anse au Diable
Nain
Paradise River
Port Hope Simpson
Postville
St. Lewis

Northern

Croque
Goose Cove East
Great Brehat
St. Anthony
St. Anthony Bight
St. Carol's
St. Julien's-Grandois
Hay Cove
L'Anse aux Meadows
Noddy Bay
Quirpon
St. Lunaire-Griquet
Englee
Boat Harbour
Cook's Harbour
Wild Bight
Cape Onion
Ship Cove
Raleigh
Main Brook
Bide Arm
Roddickton
Conche

Central

Change Islands
Deep Bay
Fogo
Island Harbour
Joe Batt's Arm
Barr'd Island
Tilting
Purbeck's Cove
Seldom-Little Seldom
Stag Harbour
Little Bay Islands
Docks Cove
Hayward's Cove
Shalloway Cove
Westport

Southern

Burgeo	La Poile
Francois	McCallum
Ramea	Monkstown
Grand Bruit	Petit Forte
Grey River	South East Bight
Rencontre East	Petites

A minimum sample size of 400 was deemed adequate to survey the population, based on minimum sub-samples of 100 in each of the four designated sub-regions, i.e. Labrador, Northern, Central and Southern. For the total sample of 400, the survey results have a confidence level of 95% and a margin of error of ± 10%. For the sub-samples of 100 in each of the four regions, the survey results have a confidence level of 90% and a margin of error of ± 10%.

Resident telephone subscribers provided the sampling frame for the study. The household member responsible for energy and insulation decisions was selected to participate in the survey.

A representative sample of households for each of the four remote areas was selected by computer utilizing software developed by Research Associates. The procedure involved a two-stage sampling technique. The first stage generated a representative list of NNX's* for each area and random assignment of the sample size for each NNX was based on the area population counts, the number of resident households served by each NNX and the total sample size of 100 required in each area. The second phase of the sampling procedure assigned a randum four-digit number for each household to be sampled. This procedure assured a random sample, a pre-requisite for estimating population parameters from the sample statistics.

A number of minor adjustments were required to the procedure for selecting the Labrador sub-sample. One of the communities, Williams Harbour, did not have resident telephone services at the time of the study and was excluded from sample selection. As well, the comunity of Mud Lake was excluded since it was part of the larger Happy Valley-Goose Bay exchange, an NNX outside the study area. These adjustments did not significantly alter the survey results as the combined population of these two communities was 150, only 2.0% of the total study area population.

* An NNX refers to the identifying first three digits of a seven-digit telephone number.

The survey was pretested using households selected at random by the method described above. The pretest resulted in the final wording and flow of the questionnaire.

The actual survey was conducted Sunday through Thursday evenings over a two-week period. The hours between 1730 and 2130 were selected to coincide with the times when most adults would be home.

Twelve interviewers conducted the survey - all were female and trained staff of Research Associates. Interviewers were instructed to dial 'busy' numbers until reached and to dial 'no answer' numbers on three separate occasions. Interviewing was conducted from a central location, coordinated and supervised by Research Associates' staff.

In total, 1710 telephone numbers were called in the survey. Of those, 47.5% were not valid telephone numbers, 1.8% were non-residential, 4.5% rang persistently busy, and 13.9% were not answered when called on three separate occasions.

The high proportion of not-valid telephone numbers is a reflection of the lower population in remote communities. A lower population base reduces the number of valid telephone numbers for each NNX. The result is more numbers have to be called to obtain the desired sample size for each NNX. This in no way affects the survey results, as the selection procedure employed guarantees a random sample.

In all, 551 households were reached for the survey and 400 (72.6%) were retained for the survey sample. The disposition of the remaining numbers were as follows: 13.8% were unable to participate in the survey when called and were not able to be reached on subsequent call-backs, 12.5% refused to participate in the survey and 1.1% were screened out.

The data were hand-coded by Research Associates' staff. Responses to open-ended questions were not classified for coding until a minimum of one hundred questionnaires had been evaluated. The data was then keypunched, entered on diskette and analyzed by computer to permit prompt analysis and interpretation.

3.1.3 Analysis Method

In order to determine the potential for energy conservation in an existing building, one must first calculate the existing rate of energy consumption, based on the structure of the building and the systems used in it. For small

residential-type buildings this procedure is quite straightforward, as most of the energy consumed by houses in this region of the world is used for space heating, and simple systems are used to provide this energy. Minor energy savings can be obtained by implementing such no-cost measures as manual setback of thermostats during the night, turning the lights off in rooms not in use, or decreasing domestic hot water usage. However, the largest potential for energy conservation in any home is decreasing the amount of energy consumed to keep the house warm (i.e. decreasing the heat loss from the building).

Calculation of the heat loss from a buiding is a well-studied, well-documented sector of the engineering field, and standard procedures have been formulated to assist in these calculations. Basically, there are seven components to consider when calculating the total heat loss for a building. These consist of the basement floor, the basement wall, the ground floor, the above-grade wall, windows, roof and infiltration heat loss. Other minor components could include such things as doors, skylights, etc. To perform the heat loss calculation, one must know the area (or volume), heat transfer coefficient, and temperature difference applicable to each of these components so that they may be calculated and summed to give the total heat loss for the building. The areas (or volumes) for each component must be measured or calculated for each individual house. The heat transfer coefficient or "U" value of a component can be obtained from tables of "U" values once the type of material and thickness are known. Finally, the temperature difference between indoor and outdoor temperatures at design conditions can be obtained if an indoor temperature of 22 degree Centigrade is assumed as an average and the design outdoor temperature (1%) is obtained from the National Building Code Supplement for the region or community in question. The basic formula for calculating heat loss or heat transfer through surfaces is:

$$Q = U \times A \times \Delta T$$

where Q = heat transfer, watts (BTU/hr)

U = heat transfer coefficient

$W/m^2\,{}^oC$ ($BTU/hr \times ft^2 \times {}^oF$)

A = Area, m^2 (ft^2)

ΔT = Temperature difference, ${}^oC$ (${}^oF$)

Infiltration heat loss is calculated using the following formula:

$$V \times N \times K \times \Delta T$$

where V = Volume, m^3 (ft^3)

N = Air changes/hr

K = .333 W/m^3

(a constant derived from

1000 l/m^3 x (1 hr/3600 s) x 1.2 j/l)

(.018 BTU/ft^3)

The average heat loss for houses in each of the four regions of the province can be estimated based on calculations using the results of the RCDP Supplementary Study survey. Nearly all pertinent information required to calculate building heat loss is available for the 400 houses covered in the survey. However, due to the nature of the survey questions pertaining to the building envelope and the questionable responses given by some of the survey participants, various assumptions had to be made for some of the survey variables in order to achieve continuity. Therefore in these cases survey questions which did not receive adequate or appropriate responses were assigned a reasonable, and in most cases average, response in order to avoid errors and erroneous results in the calculations.

Since all the survey results have been coded, keypunched and saved on computer tape, it was determined to be most economic and feasible to write a program to perform the heat loss calculations, and also to determine the potential for energy conservation and how much energy and money could be saved.

A detailed analysis of the applicable survey variables was carried out and a program was written to calculate the existing and optimum heat loss for each of the 400 houses surveyed, and thus the energy conservation potential could be derived.

A brief description of how each of the heat loss components was calculated and the assumptions made follows. The seven components contributing to the total building heat loss are:

a) Basement floor heat loss
b) Ground floor heat loss

c) Basement wall heat loss
d) Above-grade wall heat loss
e) Window heat loss
f) Roof heat loss
g) Infiltration heat loss

a) Basement floor heat loss is that energy lost through the basement floor into the ground. Since the rate of heat flow into the ground decreases with increasing depth below grade, it is obvious that the heat loss through each square meter of basement floor is very small compared to the total basement heat loss. Based on ASHRAE recommendations, an average volume for basement floor heat loss of 0.24 BTU/(h)(sq.ft.)(F) can be used for average-sized houses with basement floors 6 feet (1.8 m) below grade. This value is simply multiplied by the basement floor and the temperature difference to obtain the heat loss.

$$Q_{\text{bsmt. floor}} = A_{\text{b.f.}} \times 0.24 \times \Delta T$$

The basic assumptions made in calculating this component are that:

1) unfinished basements are unheated and therefore there will be no basement floor heat loss;

2) partially finished basements were assumed to be 50% finished and therefore 50% heated;

3) a house with no basement has no basement floor heat loss;

4) basement floor is six feet below grade.

b) Ground floor heat loss is that heat lost through the ground floor to the outside or to an unheated basement or crawl space. To calculate this component, the ground floor area over unheated space must be derived and multiplied by the floor heat transfer coefficient ("U" factor). Assumptions made are as follows:

1) unfinished basements are unheated and finished basements are heated;

2) houses with insulated floors have, on average, two-inch batt insulation in the floor;

3) the basic floor construction has an R value of 1.77 (h)(sq.ft.)(F)/BTU;

4) uninsulated ground floors have an average "U" factor of .56 BTU/(h)(sq.ft.)(F).

The formula for ground floor heat loss is:

$$Q \text{ ground floor} = A \text{ g.f.} \times U \text{ g.f.} \times \Delta T$$

c) Basement wall heat loss is that heat lost through the basement wall to the outside or to the ground. This heat loss varies with the depth below grade, the conductivity of the soil, and the R value of the wall. For the purposes of this study, basement walls have been assumed to extend 6 feet (1.8 m) below grade. Assuming this, and knowing the R value of the wall based on survey data, ASHRAE Fundamentals Handbook lists recommended "U" values for various depths below grade. Other assumptions made were as follows:

1) houses with no basements have no basement wall heat loss;

2) partially finished basements are 50% finished and therefore 50% heated;

3) the perimeter of the basement walls can be approximated by the formula:

$$\text{Perimeter} = \sqrt{\text{Area (Bsmt Floor)}} \times 4$$

4) houses with insulated basement walls have two inches of insulation;

5) the basic basement wall construction has an R value of 2.23 (h)(sq.ft.)(F)/BTU;

6) uninsulated basement walls have an average "U" factor of 1.08 BTU/(h)(sq.ft.)(F).

The formula for calculating basement wall heat loss is:

$$Q \text{ bsmt wall} = \text{Perimeter} \times U \text{ b.w.} \times \Delta T$$

d) Above-grade wall heat loss is that heat lost through the stud walls to the outside air. This calculation is straightforward once the area and "U" value have been determined from the survey data. The above-grade wall area was estimated based on the above-grade living area, the ceiling height and the window area. The wall

insulation value was calculated from the type and thickness of insulation indicated on the survey sheet. The assumptions made in calculating this component were:

1) batt insulation was assumed if survey participants did not know the type;

2) basic wall structure R value is 3.82;

3) walls were assumed to be uninsulated if survey participants did not know;

4) all living area was assumed to be heated;

5) uninsulated walls have a "U" value of .262 BTU/(h)(sq.ft.)(F).

The formula for above-grade wall heat loss is:

$$Q_{wall} = A_{wall} \times U_{wall} \times \Delta T$$

e) Window heat loss is simply the heat lost through the glass in the walls. This quantity is calculated based on the area and type of glass indicated on the survey forms. The following assumptions were made about window heat loss:

1) windows had inside shading devices;

2) double-glazed windows have a 12 mm air space;

3) if respondents did not know the type of window, single-glazed units with no storm sashes were assumed.

The formula for window heat loss is:

$$Q_{window} = A_{window} \times U_{window} \times \Delta T$$

f) Roof heat loss consists of the energy lost up through the ceiling and into the vented attic space. The roof area and insulation type and thickness were easily obtained from each of the survey forms and used to calculate this component. Some of the assumptions made in calculating this component were:

1) all living area was assumed to be heated;

2) batt type insulation was assumed if respondents did not know the type used;

3) basic ceiling structure R value is 1.23 (h)(sq.ft.)(F)/BTU;

4) uninsulated roofs have an average "U" value of .813 BTU/(hr)(sq.ft.)(F).

The formula for calculating roof heat loss is:

$$Q_{roof} = A_{roof} \times U_{roof} \times \Delta T$$

g) Infiltration heat loss is that heat energy required to heat up cold outdoor air that finds its way into the house through window and door cracks, wall cracks, open windows or doors. This heat loss is calculated by determining the volume of the house and estimating the number of air changes per hour occurring due to air leakage. The number of air changes assigned depends on whether or not the windows have storm windows and if they are properly weatherstripped. The assumptions made in these calculations (based on ASHRAE recommendations) are:

1) houses with storm windows have an air change rate of 1.0;

2) houses with no storm windows have an air change rate of 1.3;

3) houses with some storm windows have an air change rate of 1.15;

4) if windows and doors have been weatherstripped lately, the air change can be reduced by .3;

5) if some windows and doors have been weatherstripped lately, the air change rate can be reduced by .15.

The formula for calculating infiltration heat loss is:

$$Q_{infiltration} = \text{Volume} \times \text{A.C.} \times .018 \times \Delta T$$

The formulas and assumptions outlined above were used to estimate the heat loss situation in households in each of the four regions. In short, these calculations represent the current status of energy conservation practices in the four regions.

In order to estimate the remaining potential for energy conservation in these regions, it was necessary to derive appropriate standards for upgrading households in order to reduce heat loss. The Canada Mortgage and Housing Corporation (CMHC) has published a document entitled "The Conservation of Energy in Buildings" which outlines recommendations and standards for upgrading the thermal efficiency of existing houses. These recommendations, which are for residential type buildings only, are aimed at improving the overall thermal efficiency of the building as well as achieving a return on investment in a relatively short period of time. These recommendations have been used in estimating the potential for energy conservation in the houses surveyed.

CMHC makes the following general recommendations for increasing the thermal efficiency of the building envelope:

1. Basement Walls. If the floor between the basement and first level is uninsulated, the basement walls should be insulated either on the inside with a minimum of R12 batt insulation or on the outside with two-inch styrofoam (R10) down to a depth 600 mm below grade.

2. Exposed Floor. Floor constructions exposed to outdoor conditions or over unheated, uninsulated basements should be fully insulated by filling the floor joist spaces with R27.8 batt insulation and covered with building paper or chicken wire.

3. Frame Walls. Fill the wall cavity (whether it is empty or partially insulated) with batt or loose fill insulation. Assuming the majority of these houses have 100 mm studs, the insulation value should be at least R14.

4. Windows. All window units should be double-glazed, giving the glass a resistance of R2.7.

5. Roof and Ceilings. In accessible attics, loose fill or batt insulation should be added if the R value is less than 40. For flat roofs, fill the joist space completely with loose fill insulation.

6. Infiltration. Decrease the rate of air infiltration into the house by caulking and weatherstripping doors and windows. Tightening the building envelope properly should decrease air infiltration down to 1/2 - 1/3 air changes per hour.

In applying the above standards recommended by CMHC the following formulas were derived for each of the characteristics described earlier:

a) Q bsmt floor = A b.f. x .024 x Δ T

b) Q ground floor = A g.f. x .036 x Δ T

c) Q bsmt wall = Perimeter x .311 x Δ T

d) Q wall = A wall x 0.65 x Δ T

e) Q window = A window x .37 x Δ T

f) Q roof = A roof x .024 x Δ T

g) Q infiltration = Volume x .009 x Δ T

As can be seen from the above discussion the existing practices and recommended standards for energy conservation can be determined for households in the four regions. For each major characteristic, and in total, the remaining potential for energy conservation can be estimated. Furthermore, by relating the potential for energy conservation to existing energy costs and energy consumption in these areas, the potential savings in dollar and energy terms can be calculated. The assumptions and formulas used in estimating conservation potential, and cost and energy savings are described below.

Conservation potential in this report is expressed as a percentage, and represents the difference between the sum of existing heat loss less the sum of reduced heat loss based on CMHC standards for upgrading existing houses. The formula for conservation potential (CP) is simply:

$$CP = \frac{\text{Existing Practices - Recommended Practices}}{\text{Existing Practices}} \times 100\%$$

Total cost savings are expressed in dollar terms and are derived by applying the conservation potential (CP) to total expenditures on electricity, oil, and wood for heating in order to produce cost savings for electricity (CSE), cost savings for oil (CSO), and cost savings for wood (CSW). The formula can be expressed as:

Total Cost Savings = CSE + CSO + CSW,

where

CSE = CP x (Expenditures on Electricity x % Electric Heating)

CSO = CP x Expenditures on Oil

and

CSW = (CP x Purchased Cords of Wood x Price Paid Per Cord) + (CP x Cords of Cut Wood x Market Value of Wood per Cord)

It should be noted that in deriving CSE it was assumed that the percentage of electricity used for heating was 65%, and in deriving CSW that the market price for a cord of cut wood was $78 per cord (based on the average price per cord for purchased wood as reported by survey respondents).

Total energy savings were expressed in BTU's and were derived by applying the estimated cost savings for each energy source to the price per BTU for that energy source in order to produce energy savings in BTU's for electricity (ESE), oil (ESO) and wood (ESW). The formula can be expressed as follows:

Total Energy Savings = ESE + ESO + ESW

where ESE = CSE/.0000293

ESO = CSO/.0000109

and ESW = CSW/.000004.

The price per BTU was determined for each of electricity, oil and wood in the following ways:

(1) $0.10/3412, where $0.10 is the estimated average price per kwh for residential properties which are using electricity for heating in communities served by the Power Distribution District of Newfoundland and Labrador Hydro, and where 3412 is the number of BTU's per kilowatt-hour;

(2) $1.81/166,500, where $1.81 is the average price per gallon ($0.40 per litre) for furnace oil in the communities under study, and where 166,500 is the number of BTU's per gallon for furnace oil; and

(3) $78.00/19,305,000, where $78.00 per cord is the average purchase price reported by survey respondents, and where 19,305,000 is the estimated number of BTU's per cord (calculated from Mark's Standard Handbook for Mechanical Engineers).

3.2 Survey Results - Major Findings

3.2.1 Regional Housing Characteristics

The large majority of respondents participating in this study indicated that they own their homes. Of the total 400 interviewed, 92% stated they own their place of residence, whereas only 8% reported that they rent the premises they occupy. This result is not surprising and is consistent with provincial statistics which indicate that a large majority of Newfoundlanders own their homes. The only notable point about the question of home tenure is that of the 8% who reported that they rent, the majority, i.e. 55%, are in Labrador.

The majority of dwellings in the survey are single, detached residences, i.e. 93%, and another 4% are mobile homes. This trend is consistent throughout the four regions. In terms of the type of structure, the majority of homes are either bungalows or two-storeys. Bungalows constitute 67% of the housing types in the four regions, and two-storeys account for a further 26%. Collectively these two housing types account for 93% of the total in the four regions.

The housing stock surveyed for this study was divided into five age groupings, i.e. 1979 to present, 1965-1978, 1950-1964, 1940-1949, and before 1940. Approximately 73% of the housing stock sampled was built after 1950. Of the remaining 27%, 8% were built during the period 1940-1949, and 14% were built prior to 1940. Six percent of respondents did not know the date of construction. The information on age of construction is presented in Table 3.1.

Table 3.1: Year of Construction by Region

Age	Region				Row Total
	Labrador	Northern	Central	Southern	
1979-pres.	22 (37)	12 (20)	16 (27)	9 (15)	59 (15)
1965-1978	53 (33)	42 (27)	25 (16)	38 (24)	158 (40)
1950-1964	12 (16)	24 (33)	14 (19)	23 (32)	73 (18)
1940-1949	5 (16)	8 (26)	12 (39)	6 (19)	31 (8)
Pre-1940	4 (7)	6 (11)	31 (55)	15 (27)	56 (14)
Unknown	4 (17)	8 (35)	2 (9)	9 (39)	23 (6)
Column Total	100 (25)	100 (25)	100 (25)	100 (25)	400 (100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

There are several other notable points respecting the age of the housing stock which are evident from Table 3.1. Even though all regions are equally represented in terms of total sample size, i.e. 100 for each region out of a total of 400, Labrador is disproportionately higher in terms of the number of homes built after 1965. Of the 217 homes built during these periods, Labrador represents 35% of the total. This relatively larger share of newer housing is perhaps a reflection of government housing programs for native people. In addition, the table indicates that of homes built during the period 1950-1964 approximately twice as many are located in the Northern and Southern regions compared to the other two areas. Further, of the houses built between 1940 and 1949, 39% are located in the Central region. Finally, of the homes built prior to 1940, the majority, i.e. 55%, are located in the Central region.

In addition to the above housing characteristics, it is noteworthy to highlight several other features in this section. The average size of a home in the four regions is 1217 square feet, with the largest homes being in the Northern region, i.e. 1279 square feet, and the smallest being in the Southern region, i.e. 1059 square feet. The percentage of houses with full basements is only 41%, and of this group only 16% report they have fully developed basements.

The information presented above clearly implies that any initiatives undertaken by EMR in remote communities should be directed towards owner-occupied, detached dwellings that are either bungalows or two-storeys built after 1950.

3.2.2 Regional Energy Use Patterns

Survey data indicates that wood is the predominant main type of heating fuel used in remote communities. As can be seen from Table 3.2, the number of respondents who report using wood as the main heating fuel is 211 or 53%. This compares to an overall provincial estimate of 29% of households using wood as the main heating fuel type (Statistics Canada 64-202: Household Facilities and Equipment).

Table 3.2: Main Type of Heating Fuel by Region

Fuel Type	Region				Row Total
	Labrador	Northern	Central	Southern	
Electric	2 (33)	2 (33)	2 (33)	0 (0)	6 (2)
Oil	34 (19)	42 (23)	36 (20)	71 (39)	183 (46)
Wood	64 (30)	56 (27)	62 (29)	29 (14)	211 (53)
Column Total	100 (25)	100 (25)	100 (25)	100 (25)	400 (100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

In terms of regional patterns, a majority of respondents in the Labrador, Northern and Central regions indicate they use wood as the main heating fuel (64%, 56% and 62% respectively), whereas in the Southern region only 29% report using wood as the main type of heating fuel.

Another very interesting point concerning the energy use patterns of survey respondents is that a very small percentage indicate they use any form of supplementary heating. Respondents were questioned on whether they have any form of supplementary heating equipment and the degree to which it is used. As indicated in Table 3.3, an average of 93% of the

400 respondents indicated they do not have any additional heating equipment., A further 1% of total respondents indicated they never use the additional heating equipment in their homes. In total, 94% of survey respondents neither have any additional heating equipment nor ever use that which they have.

Table 3.3: Availability and Use of Additional Heating Equipment

Type	% Respondents No	% Respondents Yes-Never Use	% Total
Electric Plug Heater	86	3	89
Electric Base-board Heater	91	2	93
Oil - Hot Water	96	0.3	96.3
Oil - Forced Air	87	2	89
Oil Stove	95	2	97
Wood Furnace	99	0.5	99.5
Oil-Wood Combination	96	0.5	96.5
Wood Stove	86	1	87
Kerosene Portable Heater	88	2	90
Fireplace - Insulated Ducts	98	0.3	98.3
Fireplace - Regular	99	0.3	99.3
Other	100	-	100
Average %	93	1	94

In addition to the results shown above, for those respondents who reported using wood as their main heating source, 78% use either a wood furnace or wood stove. Only 21% reported having a wood-oil combination furnace.

The results presented above, specifically the large percentage of respondents who reported using wood as their main heating source relative to the provincial average, and the limited availability and usage of supplementary heating equipment, suggest that wood is being both extensively exploited and relied upon heavily in remote communities where it is available. This is further reinforced by examining how wood is obtained, i.e. purchased, cut or both, and the distances travelled to collect it. Of the respondents who reported using wood as a heating source, 91% cut their own wood and a further 4% reported they both purchase and cut their wood supply. In total, therefore, some 95% of people burning wood cut all or some portion of their fuelwood. Further, 66% of the people who cut wood do it within ten miles of their homes, and 91% are cutting it within 20 miles of their communities. It appears, therefore, that for those communities where wood is the major heating source, the heavy dependence on this fuel type is a function of both availability and accessibility. While the results of the survey do not prove this premise conclusively, the evidence as presented above seems to support such an hypothesis.

In terms of the relationship between energy use patterns and socio-economic variables the survey results did not produce any major surprises. The relationship between the major type of heating fuel used and socio-economic variables can be summarized as follows:

- With the exception of the 45-64 age groups, the tendency to use wood as the principal heating source decreases as age increases.

- With the exception of people in the $35,000 - $44,999 income bracket, the tendency to use wood as the major heating source declines significantly as income increases. Specifically, of those earning less than $10,000 per year, 65% use wood as the main heating source, compared to only 17% of those earning over $45,000 per year who use wood as the main heating source.

- The education level of an individual also influences their decision to burn wood. The percentage of people burning wood decreases as education level increases. Specifically, 59% of the people who have less than Grade 8 education report using wood as the main heating fuel, whereas only 31% of those who are university graduates use wood as the main heating fuel.

- For people who have been unemployed in the past 12 months, 65% reported using wood as the main heating fuel, whereas only 43% of people who were not unemployed use wood as the main heating source.

The above statements on the relationship between main heating fuel and socio-economic variables are for the most part self-explanatory. Younger people are normally better physically conditioned and more mobile than older people and therefore are more inclined to undertaken the initiatives required to obtain wood for heating. People earning higher incomes and having higher education levels are normally employed and therefore have less time available to supply their energy requirements from non-conventional sources. An important point to remember when associating the relationship between main heating source and socio-economic variables with the energy use patterns described earlier in this section is that the energy use patterns reflect the responses of the "typical" respondent.

In terms of energy consumption patterns, Tables 3.4 and 3.5 provide a regional breakdown of estimated average annual consumption by main fuel type,i.e. oil and wood respectively.

Table 3.4: Estimated Average Annual Consumption of Main Fuel Type - Oil, By Region

Region	Total Annual Expend. Oil	Numbers Using Oil as Main Fuel Type	Average Annual Expend. Oil	Est. Average Annual Consumption Oil (Gallons)*
Labrador	$72,677	34	$2,138	1181
Northern	$78,063	42	$1,858	1026
Central	$67,528	36	$1,875	1036
Southern	$98,505	71	$1,387	767
Total	$316,775	183	$1,731	956

* Based on average price of $1.81 per gallon.

Table 3.5: Estimated Average Annual Consumption of Main Fuel Type - Wood, by Region

Region	Total Number Cords - Cut and Purchased	Number Using Wood as Main Fuel Type	Est. Average Consumption Wood (Cords)
Labrador	1034	64	16.2
Northern	521	56	9.3
Central	547	62	8.8
Southern	238	29	8.2
Total	2339	211	11.1

In reviewing Table 3.4 it can be seen that the average annual consumption of oil is highest in Labrador, i.e. 1181 gallons, and lowest in the Southern region, i.e. 767 gallons. This trend is consistent with expectations that heating requirements are highest in Labrador and decrease as one moves southward towards a more temperate climate. It should be noted that these estimated annual average consumption statistics are based not on heating requirements but on actual dollars expended as reported by respondents. Therefore these estimates must take into consideration the total household income available in the regions. Survey results indicate that 56% of respondents have total household incomes less than $16,000, and that 81% of respondents have total household incomes less than $25,000. Clearly, when over half of the respondents have incomes less than $16,000 and the average expenditure on oil is $1,731, the cost of heating fuel would represent a substantial percentage of total household expenditures. Given this situation, it would be normal for people to limit their expenditures on oil. The situation being experienced by residents in remote communities is better understood when examined in the context of provincial statistics. A survey conducted by Statistics Canada in 1982 indicates that in Newfoundland 5.1% of total family expenditures were for "water, fuel and electricity" (Statistics Canada Catalogue 62-555: Family Expenditures in Canada, 1982). While the survey conducted for this study did not ask people for expenditures on water, the questionnaire did address oil and electricity expenditures. As referenced previously, the average annual expenditures for oil by households using oil as the main heating fuel was $1,731. The average annual expenditure for electricity was $592 per household. Collectively, oil and electricity expenditures average $2,323 for households using oil as the main heating

fuel. The estimated average total household income for households using oil as the main heating source is assumed to be comparable to the average for all respondents, i.e. $21,219. This assumption is based upon the fact that 77% of respondents using oil as the main heating source have household incomes less than $25,000, whereas 81% of all respondents have incomes less than $25,000. Given the estimated average annual expenditure of $2,323 for households using oil, and the estimated average annual household income of $21,219, householders in remote communities expend 11% of their household income on energy-related expenditures as comapred to the provincial average of 5.1% referenced above. While these statistics are not directly comparable, i.e. expenditures on water are excluded, and while in the case of the Statistics Canada survey the expenditures are expressed as a percentage of family expenditures as opposed to this survey which expresses expenditures as a percentage of household income, the difference between the definition of household income and family expenditures is not significant enough to require major adjustments to the above comparison.

In reviewing Table 3.5, it can be seen that the average annual consumption of wood as the main heating source is 11.1 cords overall. This varies significantly from a high of 16.2 cords in Labrador to a low of 8.2 cords in the Southern region. As was the trend with average oil consumption, the average consumption of wood decreases as one moves from Labrador toward the Southern region.

3.2.3 Regional Socio-Economic Characteristics

The respondents who participated in the survey were questioned on their gender, age, household size, occupation, employment status, household income and education level. The information on the gender of respondents by region is shown in Table 3.6.

Table 3.6: Gender of Respondents by Region

Gender	Region				Row Total	
	Labrador	Northern	Central	Southern		
Males	71	50	44	56	221	(55)
Females	29	50	56	44	179	(45)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

In terms of gender, 55% of the respondents were male, and 45% were female. Regionally, the Northern Peninsula was evenly distributed, i.e. 50% male and female, the Central region was 44% male and 56% female, and the Southern region was the opposite of the Central area, i.e. 44% female and 56% male. Labrador was the only notable exception to the general trend. For this region, 72% of respondents were male, whereas 29% were female.

In terms of age, respondents were categorized into five age groups: less than 25, 25-34, 35-44, 45-64, over 65. Given these age groupings, the 400 respondents can be classified as shown in Table 3.7.

Table 3.7: Age of Respondents by Region

Age Grouping	Region Labrador	Northern	Central	Southern	Row Total
< 25	5	3	7	10	25 (6)
25-34	42	31	26	36	135 (34)
35-44	25	25	21	28	99 (25)
45-64	26	32	32	21	111 (28)
Over 65	2	9	14	5	30 (8)
Column Total	100	100	100	100	400 (100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

The above statistics indicate the largest group of respondents were between the ages of 25 and 34 and the next largest grouping were between 45 and 64. A substantial proportion of respondents were between 35 and 44. Only a small percentage of total respondents were less than 25, or over 65.

Survey participants were questioned as to their usual occupation and responses were classified according to three categories: primary, other, and not in labour force. The usual occupation of respondents by region is shown in Table 3.8.

Table 3.8: Usual Occupation of Respondents by Region

Usual Occupation	Region				Row Total	
	Labrador	Northern	Central	Southern		
Primary	38	25	20	28	111	(28)
Other	41	47	30	34	152	(38)
Not in Labour Force	21	28	50	38	137	(34)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents the percentage the row total is of total respondents. Percentages may not add due to rounding.

As shown in Table 3.8, the number of respondents who are not in the labour force, i.e. normally housewives and retired persons, is significant at 34%. This situation, however, should be viewed in light of the gender of respondents, 45% of whom were female. It is important to note that the smallest number of people not in the labour force are in Labrador, whereas the largest number are in the Central region.

Respondents who were employed in primary or other occupations were asked their employment status for the last 12 months. This information is presented in Table 3.9.

Table 3.9: Employment Status by Region

Unemployed Past Year	Region				Row Total	
	Labrador	Northern	Central	Southern		
Yes	45	28	22	31	126	(48)
No	34	43	28	31	136	(52)
Total	79	71	50	62	262	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

As is illustrated in the above table, 48% of those employed in primary or other occupations were unemployed at some point during the past year. This ranges from a high of 57% in Labrador to a low of 39% in the Northern region. The Central region was 44% and the Southern area was 50%. In addition to the question dealing with employment status, respondents were asked how many weeks during the past year they were unemployed. For all regions the average period of unemplyment was 5.5 months. Both the large number of people who were unemployed during the past year and the length of unemplyment are not surprising because most remote communities are based upon primary industries, i.e. normally inshore fishing, and therefore experience seasonal work patterns.

The education level of respondents in remote communities is shown in Table 3.10.

Table 3.10: Education Level of Respondents by Region

Education Level	Region				Row Total	
	Labrador	Northern	Central	Southern		
Less than Grade 8	29	15	16	23	83	(21)
Completed Grade 8	22	20	24	21	87	(22)
Some High or Voc. School	16	30	31	31	108	(27)
Completed High or Voc. School	16	18	15	17	66	(17)
Some Voc. School	-	-	1	-	1	(.5)
Completed Voc. School	-	1	4	2	7	(2)
Some University	6	9	3	1	19	(5)
Completed University	11	7	6	5	29	(7)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

The information presented in the above table indicates education levels are generally low for residents of remote communities. Overall, 43% of respondents have grade 8 or lower. This situation was worst in Labrador where 51% of respondents have grade 8 or less. A further 27% have either some high school or some vocational school training, and 17% have completed either high school or vocational school. A

very small number of people, i.e. 7% have completed university. Ironically, while Labrador had the highest percentage with grade 8 or less education, it had the highest number of university graduates, i.e. 11 out of 29.

The total annual household income level of respondents in the four regions is presented in Table 3.11.

Table 3.11: Total Annual Household Income Level by Region

Household Income Level	Region				Row Total	
	Labrador	Northern	Central	Southern		
< $10,000	30	24	33	17	104	(26)
$10-15,999	30	27	26	37	120	(30)
$16-24,999	22	29	21	26	98	(25)
$25-34,999	7	10	10	14	41	(10)
$35-44,999	4	2	3	1	10	(3)
> $45,000	6	2	4	-	12	(3)
Refused	1	-	3	5	15	(4)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

The data presented above indicates that the majority of respondents, i.e. 56%, have total household incomes less than $16,000 per year. A further 25%, or a total of 81% of all respondents, have total household incomes less than $25,000. It is worth noting that this pattern is consistent through all regions. These relatively low income levels are consistent with the seasonal nature of work in many remote communities.

3.2.4 Regional Energy Conservation Standards and Practices

Respondents were questioned as to the existing energy conservation standards in their place of residence in order to provide the baseline information required to estimate conservation potential. Information was collected on a number of variables. The most important of these are: basement wall insulation, ground floor insulation, above-grade wall insulation, attic insulation, window glazing, storm windows and doors and weatherstripping.

In addition to the information on existing energy conservation standards, respondents were questioned as to whether they had taken advantage of either the Canadian Home Insulation Program (CHIP) or the Canadian Oil Substitution Program (COSP). If they had, questions were then asked concerning when they had used either of the two programs, for what purpose, and how much money they received. If they had not used either of the programs, questions were asked concerning whether they had any intentions of using either program and for what purpose.

Respondents were questioned as to whether their basement walls were insulated and the type of insulation used. Table 3.12 indicates by region whether households had any basement wall insulation. Table 3.13 indicates by region the type of basement wall insulation used.

Table 3.12: Basement Wall Insulation by Region

Bsmt. Walls Insulated	Region				Row Total	
	Labrador	Northern	Central	Southern		
Yes	25	22	9	10	66	(35)
No	23	32	23	33	111	(59)
Don't Know	-	-	-	1	1	(.5)
Partial	1	5	2	3	11	(6)
Column Total	49	59	34	47	189	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

Table 3.13: Type of Basement Wall Insulation by Region

Insulation Type	Region				Row Total	
	Labrador	Northern	Central	Southern		
Batt	12	9	4	8	33	(43)
Polybead	9	14	5	4	32	(42)
Other	3	4	1	1	9	(12)
Don't Know	2	1	-	-	3	(4)
Column Total	26	28	10	13	77	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

As is shown in Table 3.12, of the 189 respondents with full or partial basements, only 66, or 35%, had their total basement wall area insulated. A further 11 respondents, or 6%, had their basement walls partially insulated. Of those respondents with the total basement wall area insulated, the majority, i.e. 47 out of 66, or 71%, reside in either Labrador or the Northern regions. Of the 77 respondents who have their basement wall area totally or partially insulated, Table 3.13 indicates that the majority, i.e. 65 out of 77, or 85%, have either batt or polybead insulation.

The information presented in the above two tables clearly implies that initiatives directed toward improving energy conservation standards in basement walls should be limited owing to the relatively small number of households for which improvements are possible. Taking into account the number of homes with full or partial basements, i.e. 189, and the number with total or partial insulation coverage, i.e. 77, only 112 households out of 400, or 28%, could be upgraded.

For respondents without basements, the question was asked whether the area below the ground floor of their home was insulated, and if so, what type of insulation was present. The responses given to these two questions are presented in Table 3.14 and 3.15 respectively.

Table 3.14: Ground Floor Insulation by Region

Floor Insulated	Region				Row Total	
	Labrador	Northern	Central	Southern		
Yes	15	8	15	14	52	(25)
No	32	32	51	34	148	(70)
Don't Know	1	3	-	2	6	(3)
Partial	-	-	3	2	5	(2)
Column Total	48	43	69	51	211	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

Table 3.15: Type of Ground Floor Insulation by Region

Insulation Type	Region				Row Total	
	Labrador	Northern	Central	Southern		
Batt	6	6	17	9	38	(66)
Polybead	2	2	1	5	9	(9)
Loose Fill	1	1	-	1	3	(5)
Other	6	-	-	1	7	(11)
Don't Know	1	-	-	-	1	(2)
Column Total	17	9	18	16	58	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

As indicated in Table 3.14, a small number of respondents, i.e. 52, or 25%, have ground floor insulation. A further 5 respondents, or 2%, reported having the ground floor partially insulated. For those homes with ground floor insulation, Table 3.15 indicates that the majority of respondents have batt insulation, i.e. 38, or 66%.

The information presented in the above two tables shows that a minimum of 148 respondents do not have ground floor insulation, and a further 6 do not know if they do. If we assume this latter group does not have any insulation in the ground floor, a total of 154 households, or 39%, of the 400 households in the survey, could benefit from energy conservation initiatives directed toward this area.

Respondents were questioned on the presence of above-grade wall insulation in their homes. Three variables were examined: presence of insulation, type of insulation and amount of insulation. This information is presented in Tables 3.16, 3.17 and 3.18, respectively.

Table 3.16: Above-Grade Wall Insulation by Region

Wall Insulated	Region				Row Total	
	Labrador	Northern	Central	Southern		
Yes	81	67	64	46	258	(65)
No	14	26	26	44	110	(28)
Don't Know	1	3	3	3	10	(3)
Partial	3	3	6	6	18	(5)
Column Total	99	99	99	99	396	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

Table 3.17: Type of Above-Grade Wall Insulation by Region

Insulation Type	No. of Respondents by Region				Row Total	
	Labrador	Northern	Central	Southern		
Batt	69	57	63	44	233	(84)
Polybead	6	2	-	5	13	(5)
Loose Fill	4	2	6	3	15	(5)
Other	3	6	-	-	9	(3)
Don't Know	3	3	1	-	7	(3)
Column Total	85	70	70	52	277	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

Table 3.18: Average Amount of Above-Grade Wall Insulation by Region

	Labrador	Northern	Central	Southern	All Regions
Average Amount (Inches)	3.4	3.6	3.6	3.1	3.5

As can be seen from Table 3.16, the majority of respondents reported having the above-grade wall area of their home fully or partially insualted. Of the 396 valid responses to this question, 258 respondents reported that their above-grade walls are fully insulated, and a further 18 respondents said their walls were partially insulated. In total, therefore, 276 respondents, or 68%, have full or partial wall insulation. It is interesting to note that of the homes

which reported the presence of above-grade wall insulation, the Labrador region has a much higher number than the other regions.

In terms of the type of insulation, Table 3.17 shows that batt insulation and loose-fill insulation are the most common types. Collectively, 89% of the respondents who have above-grade wall insulation use either of these two types.

Table 3.18 shows the average number of inches of wall insulation in homes as reported by respondents. Of the total respondents who reported having their above-grade walls fully or partially insulated, i.e. 276, 208 responded to this question. Sixty-eight respondents either did not know the amount of insulation in their walls or did not respond to this question. For the 208 who did respond the average amount of wall insulation is 3.5 inches. If the assumption is made that 4 inches of wall insulation is the retrofit standard for existiyng homes,the survey results imply that for these 208 respondents there is no potential for increasing the above-grade wall insulation levels in their homes. Because it is impossible to estimate the amount of wall insulation which is in the homes of the 68 respondents who did not respond to this question, no conclusions about the potential for this group are possible. Of the valid respondents which remain, 110 reported having no insulation in their walls, and 10 reported that they did not know if the walls were insulated. As it is plausible to assume that those who do not know if their walls are insulated likely do not have insulation, then a maximum of 120 households, or 30% of the total respondents, have potential for improvements in this area.

Respondents were questioned as to whether there was any insulation in their attic. If the response was positive, they were then asked the type and amount of insulation present. Tables 3.19, 3.20 and 3.21 provide information on the presence, type and amount of attic insulation.

Table 3.19: Attic Insulation by Region

Attic Insulated	No. of Respondents by Region				Row Total	
	Labrador	Northern	Central	Southern		
Yes	72	75	66	74	287	(72)
No	18	17	23	21	79	(20)
Don't Know	3	2	1	2	8	(2)
No Attic	3	2	-	1	6	(2)
Partial	4	3	9	1	17	(4)
Column Total	100	99	99	99	397	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

Table 3.20: Type of Attic Insulation by Region

Insulation Type	No. of Respondents by Region				Row Total	
	Labrador	Northern	Central	Southern		
Batt	55	56	68	63	242	(80)
Polybead	1	2	-	8	11	(4)
Loose Fill	13	15	5	-	33	(11)
Other	6	2	-	2	10	(3)
Don't Know	2	3	1	1	7	(2)
Column Total	77	78	74	74	303	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

Table 3.21: Average Amount of Attic Insulation by Region

	Labrador	Northern	Central	Southern	All Regions
Average Amount (Inches)	4.4	5.1	5.1	4.6	4.8

The information presented in Table 3.19 indicates a significant proportion of the respondents in the four regions have insulation in their attic. Some 287 respondents, or 72% of the total, have their attic area fully insulated, and a further 17 people, or 4%, indicated some portion of their attic is insulated. Collectively, a total of 304 respondents, or 76%, have their attic either fully or partially insulated.

Table 3.20 indicates respondents in all regions have a clear preference for batt insulation. Some 242 respondents, or 80% of those reporting the presence of attic insulation, stated their attic area is insulated with batts. A further 33 respondents, or 11%, indicated their attic is insulated with loose-fill insulation. Collectively, some 275 respondents, or 91%, have batt or loose-fill insulation in their attic.

Table 3.21 shows the average amount of attic insulation reported by respondents. For the 233 respondents who answered this question (70 respondents did not know the amount of attic insulation in their homes), the average amount of insulation was 4.8 inches.

The information presented in the above three tables suggests there are substantial opportunities for upgrading the attic insulation levels of households in remote communities. Given the existing average attic insulation level of 5.0 inches per household for the 304 respondients who reported having their attic area fully or partially covered with insulation, and the recommended CMHC standard of 12 inches per household, i.e. R40, it is clear that substantial retrofit potential exists. Further, if we assume that the 6 respondents who did not know if attic insulation was present do not have insulation, and combine this with the 79 respondents who reported having no attic insulation, then 85 households can be fully upgraded to the CMHC standard.

Respondents were also questioned as to the type of window glazing in their homes. This information is presented in Table 3.22.

Table 3.22: Window Glazing by Region

Glazing Type	No. of Respondents by Region				Row Total	
	Labrador	Northern	Central	Southern		
Single	32	21	33	36	122	(31)
Double	64	73	60	54	251	(63)
Triple	-	2	-	-	2	(1)
Combination	4	4	7	9	24	(6)
Don't Know	-	-	-	1	1	(0.3)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

The above table indicates that the majority of homes in each region have double-glazed windows. Of the total 400 respondents, 251, or 63%, have this type of window. Triple glazing is very rare - only 2 respondents in the Northern region, and combinations of single and double glazed windows are reported by only 24 respondents. Given this situation, the potential for upgrading to the recommended standard of double-glazed windows is possible for 122 respondents, or 31%.

Information on the presence of storm windows by region is presented in Table 3.23.

Table 3.23: Storm Windows by Region

Response Category	No. of Respondents by Region					
	Labrador	Northern	Central	Southern	Row Total	
Yes	26	30	28	43	127	(32)
No	69	68	71	55	263	(66)
Some	3	2	-	2	7	(2)
Don't Know	2	-	1	-	3	(1)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

The majority of houses in each region do not have storm windows. The fact that 263 respondents, or 66% replied "no" to this question likely reflects the large number of people who have double-glazed windows as referenced above.

Respondents were questioned as to whether they had weatherstripped their doors and windows in the past three years. Table 3.24 presents this information.

Table 3.24: Weatherstripping by Region

Response Category	No. of Respondents by Region				Row Total	
	Labrador	Northern	Central	Southern		
Yes	41	40	44	44	169	(42)
No	57	58	55	53	223	(56)
Some	2	2	1	3	8	(2)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

As indicated in Table 3.24, the majority of respondents, i.e. 223, or 56%, have not weatherstripped their doors and windows in the past three years. This pattern is consistent throughout all four regions and represents an opportunity for an inexpensive and relatively effective way to reduce building heat loss.

As referenced in the introductory comments to this section, respondents were questioned as to whether they had used either the CHIP or COSP programs, and if so, when they had used it, for what purpose, and the dollar value of the grant they received. If they had not availed of either of these opportunities, people were questioned as to whether they intended to use these programs. Table 3.25 presents the information on the number of respondents who have used either the CHIP or COSP programs.

Table 3.25: Use of CHIP/COSP by Region

Response Category	No. of Respondents by Region					
	Labrador	Northern	Central	Southern	Row Total	
CHIP-Yes	17	28	26	31	102	(26)
COSP-Yes	6	8	12	4	30	(8)
Both-Yes	2	9	11	6	28	(7)
Neither	75	55	51	59	240	(60)
Column Total	100	100	100	100	400	(100)

Note: Number in brackets represents row and column percentages respectively. Percentages may not add due to rounding.

As is illustrated in Table 3.25, the majority of respondents have not participated in either the CHIP or COSP programs. Some 240 respondents, or 60% of total respondents, indicated they had not applied for assistance under either program. It is important to note that the region in which energy conservation investments would probably produce the greatest returns, i.e. Labrador, had 75% of respondents stating they had not participated in either program. If it is assumed that the use of CHIP or COSP reflects, in part, the interest of a person in energy conservation, and therefore is an indicator of the potential receptiveness to energy conservation initiatives should they be undertaken as part of the RCDP program, the results presented in Table 3.25 would favour the Central region as the location for RCDP actions. Another potential indicator of interest in energy conservation, and therefore possible receptiveness to RCDP energy conservation initiatives, is the number of respondents who indicated they intended to use these programs in the future. Of the 340 respondents who replied to this question, a very small number - only 71 respondents, or 21% - indicated they intended to use either of these programs.

For respondents who have used the CHIP, COSP, or both programs, the question of when they had used these programs was asked. For the CHIP program, the period between 1980-81 was the average period reported by respondents, and for the COSP program, the period between 1981-82 was the average

response. Respondents were questioned as to the purpose for which they had used either the CHIP or COSP programs. This information is presented in Table 3.26.

Table 3.26: Purpose of CHIP-COSP by Region

Purpose	No. of Respondents by Region				Row Total
	Labrador	Northern	Central	Southern	
Insulation	18	38	39	38	133
Conversion - Wood	11	10	18	12	51
Retrofit	1	1	1	-	3
Valid Responses	25	45	49	41	160

Note: Because certain respondents have used these programs for more than one action, i.e. to both convert and insulate, column totals may not add.

As indicated in Table 3.26, the majority of respondents have used the CHIP or COSP programs for insulation. Of the 160 people who responded to this question, 133 respondents, or 83%, reported using the grant money for insulation. Only 51 people, or 32%, used the grant money for conversion to wood heating. This latter point is important in supporting certain general comments made earlier in the report concerning the use of wood as a main heating fuel. Readers will recall that 211 respondents, or 53% of the total 400 respondents, reported using wood as their main heating fuel. The information presented above indicates that 51 respondents, or 24% of those respondents using wood as the main heating source, converted from oil to wood as a result of federal government grants. While this information shows that the objective of displacing oil consumption is being met in part, it also suggests that the majority of those using wood in remote communities are doing so independent of government grants. In other words, wood is being used as a main heating source apparently because it is available in sufficient quantities, is easily accessible, and is a relatively cheap source of energy.

Respondents who have used the CHIP or COSP programs were questioned as to the amount of grant money received. Table 3.27 shows the average amount received by respondents for each program by region.

Table 3.27: Average Amount of Money Received for CHIP and COSP by Region

Program	Average Dollar Amount Reported by Region				All Regions
	Labrador	Northern	Central	Southern	
CHIP	388	332	334	373	352
COSP	470	518	435	445	467

3.3 Potential for Energy Conservation

Based on the methodology outlined in section 3.1, and the survey results presented in section 3.2, the potential for energy conservation in the four regions and overall can be estimated. In calculating the potential for energy conservation, each of the seven major areas of heat loss associated with residential properties was taken into consideration. These areas include: basement floor heat loss, ground floor heat loss, basement wall heat loss, above-grade wall heat loss, heat loss through windows, roof heat loss and infiltration. For each of these characteristics, Table 3.28 provides a regional and overall analysis of the existing heat loss situation as calculated from information supplied by the survey respondents, and of the potential for heat loss reduction should homes be upgraded to the standards recommended by CMHC.

The information presented in Table 3.28 indicates that the overall potential for energy conservation in remote communities is 72%. This potential varies slightly on a regional basis in the following way: Labrador - 72%; Northern Peninsula - 70%; Central Newfoundland - 73%; and Southern Newfoundland - 71%.

The information in Table 3.28 indicates that the major areas of heat loss are the ground floor and the attic. On an overall basis, the ground floor and the attic represent 37% and 35% respectively of the potential reductions which could be attained by upgrading to CMHC standards. Collectively,

Table 3.28: Energy Conservation Potential by Region

MEAN HEAT LOSS BY REGION (BTU's/hr)

Household Characteristics	Labrador			Northern			Central			Southern			All Regions		
	Existing	Upgraded	Potential Reduction	Existing	Upgraded	Potential Reduction	Existing	Upgraded	Potential Reduction	Existing	Upgraded	Potential Reduction	Existing	Upgraded	Potential Reduction
Basement Floor	483	483	-	430	430	-	152	152	-	244	244	-	327	327	-
Ground Floor	26,998	2,021	24,977	27,089	1,892	25,197	24,369	1,787	22,852	17,567	1,296	16,271	24,006	1,749	22,257
Basement Wall	1,864	989	875	1,822	828	994	674	294	380	1,297	519	778	1,415	658	757
Above-Grade Wall	12,009	5,363	6,646	13,116	5,086	8,030	10,571	4,239	6,332	9,874	3,243	6,631	11,393	4,482	6,911
Windows	4,122	2,378	1,744	4,028	2,639	1,389	3,823	2,196	1,627	2,679	1,645	1,034	3,663	2,215	1,448
Roof and Attic	26,966	1,883	25,083	25,660	1,783	23,877	19,547	1,486	18,061	17,488	1,158	16,330	22,415	1,578	20,837
Infiltration	17,342	7,867	9,475	17,014	7,854	9,160	12,816	5,848	6,968	9,150	4,519	4,631	14,081	6,522	7,559
Total	89,784	20,985	68,880	89,159	20,512	68,647	72,222	16,002	56,220	58,299	12,624	45,675	77,300	17,531	59,769
Conservation Potential		72%			70%			73%			71%			72%	

improvements in these two areas could reduce heat loss by 72%. When examined on a regional basis, the collective importance of these two areas in providing the optimal potential for heat loss reduction is consistent with the overall trend. In Labrador, the potential for heat loss reduction associated with the ground floor and the attic is 36% for each area, in the Northern region it is 37% and 35% respectively, for the Central region it is 41% and 32% respectively, and for the Southern region it is 36% for each area.

In addition to the ground floor and the attic as major areas for potential reductions in heat loss, the results presented in Table 3.28 indicate that reducing infiltration heat losses and heat losses through the above-grade wall could contribute a further 13% and 12% respectively to the overall potential for heat loss reduction. The overall trend of a potential 25% reduction in heat loss for these two areas is consistent throughout the four regions. In Labrador, the potential for heat loss reduction associated with infiltration and the above-grade wall is 14% and 10% respectively, in the Northern region it is 13% and 12% respectively, in the Central region it is 12% and 11% respectively, and in the Southern region it is 10% and 15% respectively.

The remaining areas of potential heat loss reduction, namely, the upgrading of windows to the double-glazing standards recommended by CMHC, and the installation of basement wall insulation, collectively account for only 4% of the overall potential for heat loss reduction in the four regions. The fact that there is no potential for heat loss reduction associated with the basement floor is based on the CMHC assumption that for existing dwellings there is generally limited opportunity for undertaking economical actions in this area.

Based on the information contained in Table 3.28 and the analysis presented above, it is evident that the potential for energy conservation - when expressed as a percentage - is essentially the same for all regions, and that the areas in which initiatives should be undertaken to reduce heat loss are also similar for all regions. While this regional consistency respecting the potential for energy conservation may appear somewhat surprising initially, it simply reinforces the information presented in section 3.2 above. Readers will recall that the information and analysis presented in section 3.2, specifically those sub-sections dealing with regional housing characteristics, regional socio-economic characteristics, and regional energy conservation standards and practices, generally concluded that there was consistency among regions, especially when discussing the "typical" respondent.

Given the consistency between regions respecting both the estimated average percentage potential for energy conservation, and the areas in which initiatives should be undertaken, the question of determining which region should receive priority has to focus on translating conservation potential into the maximum energy and cost savings that are possible.

Table 3.29 presents the total estimated energy savings per household by fuel type and region.

Table 3.29: Total Estimated Annual Energy Savings per Household by Fuel Type and Region

Fuel Type	Estimated Annual Energy Savings Per Household by Region (millions of BTU's)				All Regions
	Labrador	Northern	Central	Southern	
Oil	47	51	44	65	52
Wood	139	77	87	31	84
Total	186	128	131	96	136

The information presented in Table 3.29 indicates that the total annual energy savings associated with this conservation potential is estimated to average 136 million BTU's per household. This varies significantly by region, ranging from a high of 186 million BTU'S in Labrador to a low of 96 million BTU's in Southern Newfoundland. The Northern Peninsula and Central Newfoundland are 128 million and 131 million BTU's respectively.

Table 3.30 presents the total estimated annual cost savings per household by fuel type and region.

Table 3.30: Total Estimated Annual Cost Savings per Household by Fuel Type and Region

Fuel Type	Total Estimated Annual Cost Savings per Household by Region (dollars)				All Regions
	Labrador	Northern	Central	Southern	
Oil	517	551	481	713	565
Wood	555	307	349	126	334
Total	1072	858	830	839	899

The total annual cost savings associated with the conservation potential identified above average $899 per household. This amount varies between regions as follows: Labrador - $1072; Northern Peninsula - $848; Central Newfoundland - $830; and Southern Newfoundland - $839.

Given the information presented in Tables 3.29 and 3.30 above, it would appear that the maximum energy and cost savings would be available in the Labrador region. Before concluding, however, that energy conservation initiatives should be implemented in Labrador, a qualifying statement must be made. In the case of Labrador, and to a lesser extent also the Northern and Central regions, the energy and especially the cost savings estimates, must take into account the fact that the majority of respondents are burning wood, and further, that they obtain their supply by cutting it themselves. Therefore, any initiatives undertaken by EMR through the RCDP program must assess the potential likelihood of respondents investing in energy conservation activities given that a majority of respondents in Labrador, and also the Northern and Central regions, obtain their energy supplies at a perceived minimal cost to them.

4.0 FUELWOOD INVENTORY CONSOLIDATION

4.1 Methodology and Approach

4.1.1 Review Available Information

The Newfoundland Department of Forest Resources and Lands have completed forest inventory maps for 18 management areas on the Island of Newfoundland, and have plans to complete inventory work for an additional seven management units within Labrador. The existing maps, some of which are based on photography work from late 1960 and early 1970, contain detailed information on commercial stands. The productive stands are numbered, the area calculated and information with respect to species, tree height and condition is summarized. The conventional forest inventory provides information on stem volumes only, and is restricted to major tree species not including trees smaller than 90 mm dbh. Little information is available on non-commercial timber stands and there is no detailed information on what percentage of the inventoried forest is now dead or dying as a result of the spruce budworm infestation.

To further complicate the task of preparing fuelwood inventory calculations for the 77 communities identified under the RCDP Program, it has been determined that no forest inventory maps are completed, or are planned for the entire south coast of the island portion of the province, and that only preliminary information is available for certain portions of Labrador.

For a summary of the locations for which Inventory Mapping is available refer to Figures 4.1 and 4.2.

Recognizing these obvious shortcomings with the existing information, and with particular concerns with respect to the growing use of fuelwood as an alternative energy source throughout the province, Environment Canada, through the ENFOR program, have undertaken a number of studies which have addressed ways and means that could be used to implement programs to obtain the missing information.

The most pertinent studies prepared under the ENFOR program with respect to this study were:

- Energy from Newfoundland's Forest Biomass, a research and development program by R. S. Van Nostrand, May 1980.

- Procedures for Estimating Newfoundland's Biomass Reserves, by Dendron Resource Surveys Ltd., Northland Associates Ltd., February 1982.

Figure 4.1
Available Inventory Maps - Labrador

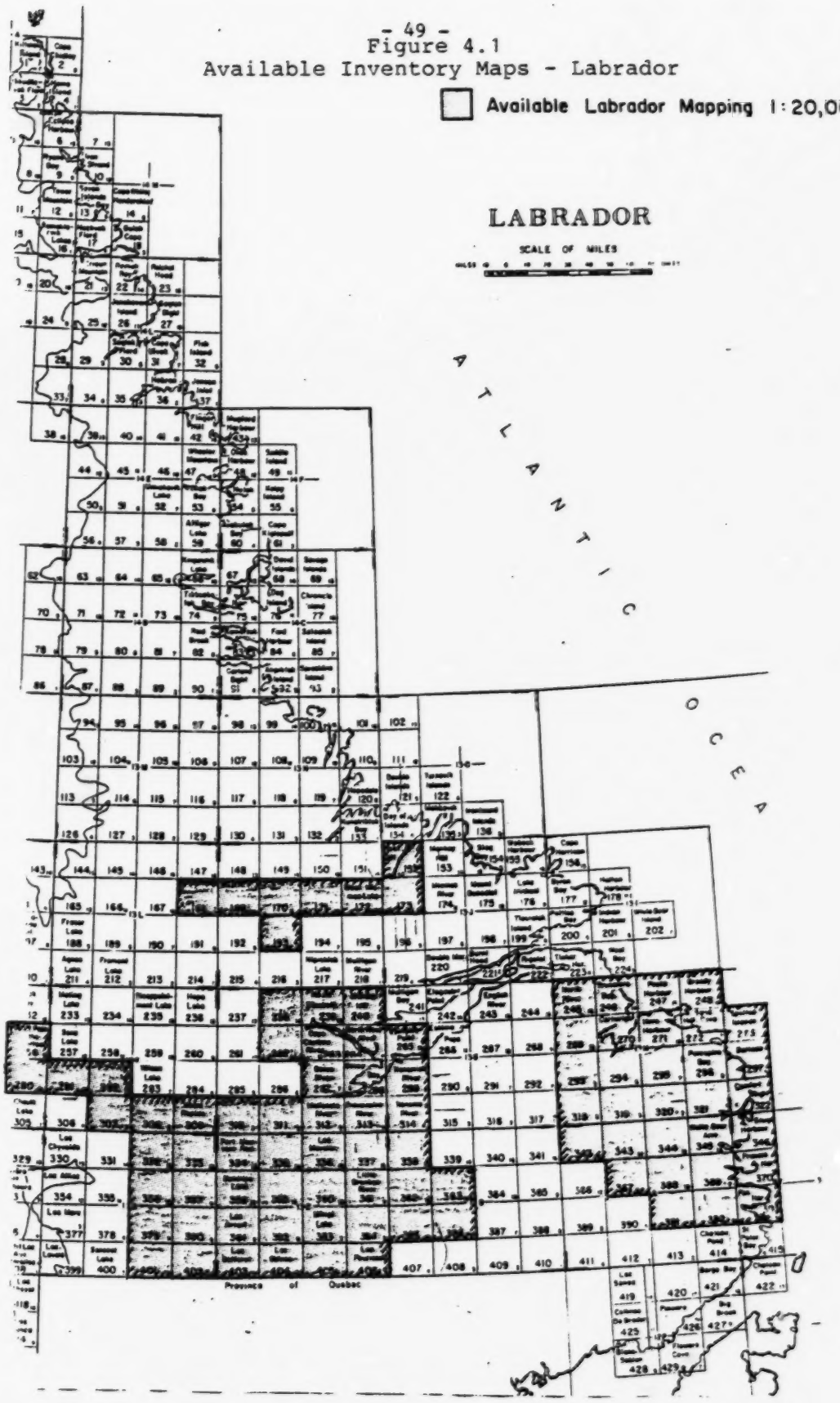


Figure 4.2
Available Inventory Maps - Newfoundland

- Domestic Fuelwood Consumption in Newfoundland, by Northland Associates Ltd., August 1984.

After a detailed assessment of all available information and documentation it has been concluded that a meaningful inventory can be attempted for the communities summarized below and that at this time there is no possibility to complete an inventory for the remaining communities using existing information.

The communites by load centre are presented below:

A. Labrador Region

Black Tickle
Cartwright
Mud Lake
Postville
Port Hope Simpson

B. Northern Region

Harbour Deep
Roddickton:
  Bide Arm
  Conche
  Englee
  Roddickton
St. Anthony
  Boat Harbour
  Cape Onion/Ship Cove
  Cooks Harbour
  Goose Cove
  Great Brehat
  Hay Cove
  L'Anse aux Meadows
  Noddy Bay
  Quirpon
  Raleigh
  St. Anthony
  St. Anthony Bight
  St. Carol
  St. Lunaire/Grandois
  Wild Bight

C. Central Region

Fogo Island:
  Peep Bay
  Fogo
  Island Harbour

Joe Batt's Arm/Barr'd Islands/Shoal Bay
Seldom/Little Seldom
Stag Harbour
Tilting
Little Bay Islands
St. Brendan's:
Dock Cove
Hayward's Cove
Shalloway Cove
St. Brendan's

These load centres are shown graphically in Figures 4.3 and 4.4 below.

4.1.2 Analysis Method

It will be noted that the 37 communities for which information is available are divided into 11 separate load centres. Using the 1:30,000 scale inventory maps for the island and 1:20,000 scale maps for Labrador, a detailed listing of the accessible timber stands has been compiled. The stands selected are based on the criteria of using a 30 km radius envelope centred at the community under consideration. Timber stands 1.5 km on either side of roadways and waterways or within 1.5 km of the coastlines are considered to be accessible to the type of equipment normally used by individuals harvesting fuelwood.

Consultations with forest technicians of the provincial Department of Forest Resources and Lands, Forest Management Division, were undertaken to determine suitable methods to determine allowable cut areas and volumes of forest stands.

The area method was used to determine the allowable annual cut in hectares for each envelope.

For the community envelopes in the Newfoundland regions, a weighted average age was determined by multiplying the area of an age class by the age class midpoint. The average normal age as used by the Department of Forestry and Lands is 35 years. The allowable normal annual cut is found by dividing the total area regardless of age by 70 years, with the initial 20-year allowable cut being that found by multiplying the allowable normal annual cut by the ratio of the weighted average age to the average normal age.

In Labrador the age of the forest stands is not readily available. Therefore the allowable annual cut was found by dividing the total accessible area by 70 years.

Figure 4.3
Load Centres Analyzed - Labrador

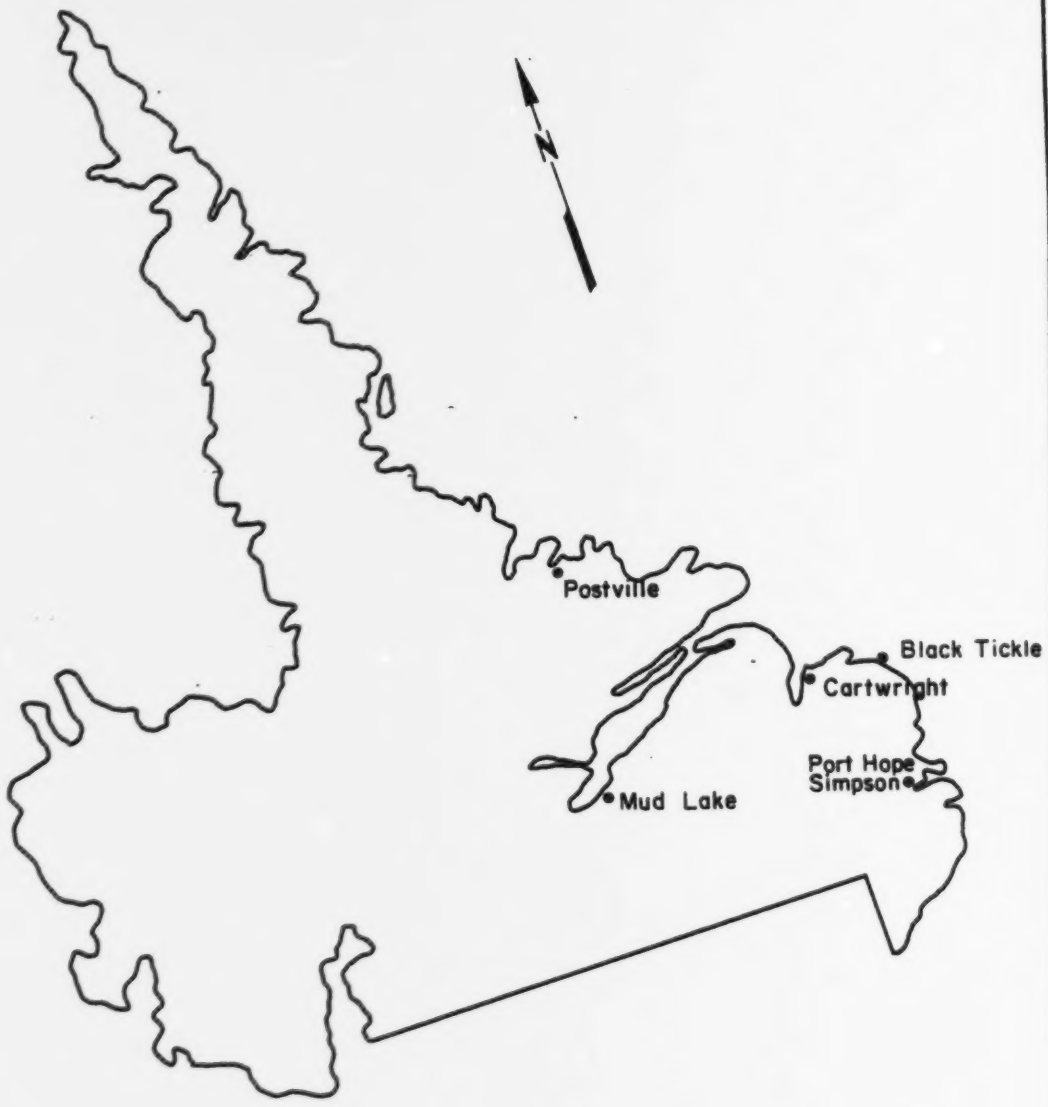


Figure 4.4
Load Centres Analyzed - Newfoundland

BFL Consultants Limited

REMOTE COMMUNITY
DEMONSTRATION PROGRAM

MAP OF NEWFOUNDLAND

Information on the average volume yields of forest areas by management unit was obtained. The data is presented on computer printouts giving average volume yield per hectare by stand type for each management unit.

The areas by stand type obtained previously were multiplied by the appropriate volume yield and average yield obtained for each species and community envelope.

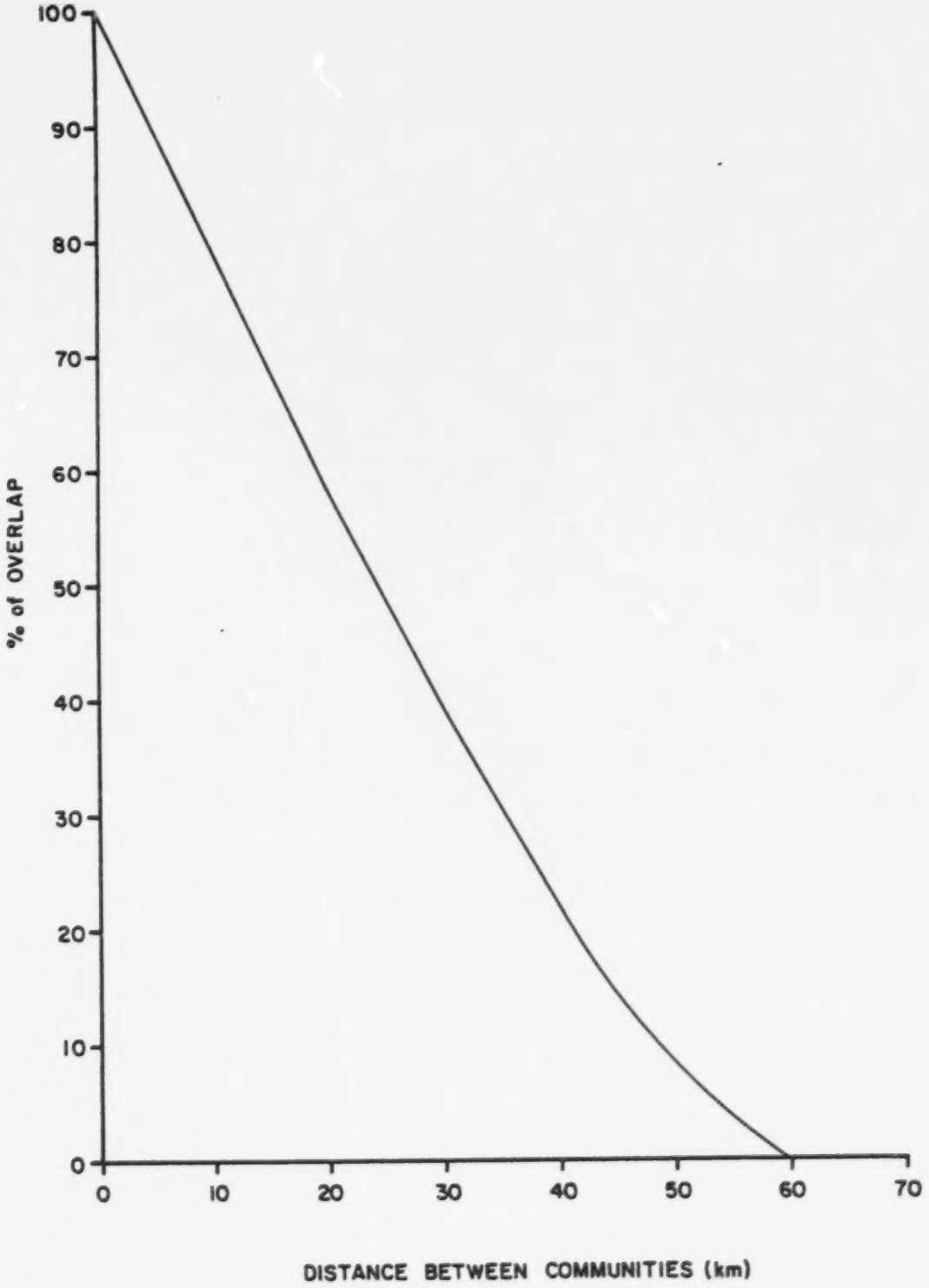
Of the eleven load centres under consideration, six of them have their reference community's envelope overlapped by other communities. In other words, the area of the 30 km radius envelope falls within areas that would come under pressure to supply fuelwood to other communities, some of which may be within the load centre while others are outside.

During our calculations these overlap percentages were determined and the graph shown in Fig. 4.5 developed.

In order to determine the significance of the sustainable yield from each of the envelopes, and the overlap influence, other information had to be determined, such as the percentage of current woodburning dwellings and the percent of the total heat currently being provided by wood for these dwellings. This information for the island portion of the province was calculated from information contained in the ENFOR reports, while it was estimated for the Labrador communities.

The detailed calculations contained in the following sections arrives at the Estimated Sustainable % Increase above the current estimated levels of consumption of the eleven load centres under consideration. This information can be directly applied to all remaining communities listed in each of the load centres as outlined in Section 4.1.1.

Figure 4.5
Overlap Percentages Relative to Distance Between Communities



4.2 Estimated Sustainable Yield Calculations

4.2.1 Estimated Sustainable Increase - Cartwright

Sustainable Yield Calculation
Reference Community - Cartwright

1. Accessible Area: 17,200 hectares
2. Allowable Annual Cut: 246 hectares
3. Percent Unsuited Area: 0.5
4. Suitable Area: 17,114 hectares
5.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	74.6	70.8
Balsam Fir	25.3	90.9
White Birch	0.1	83.6

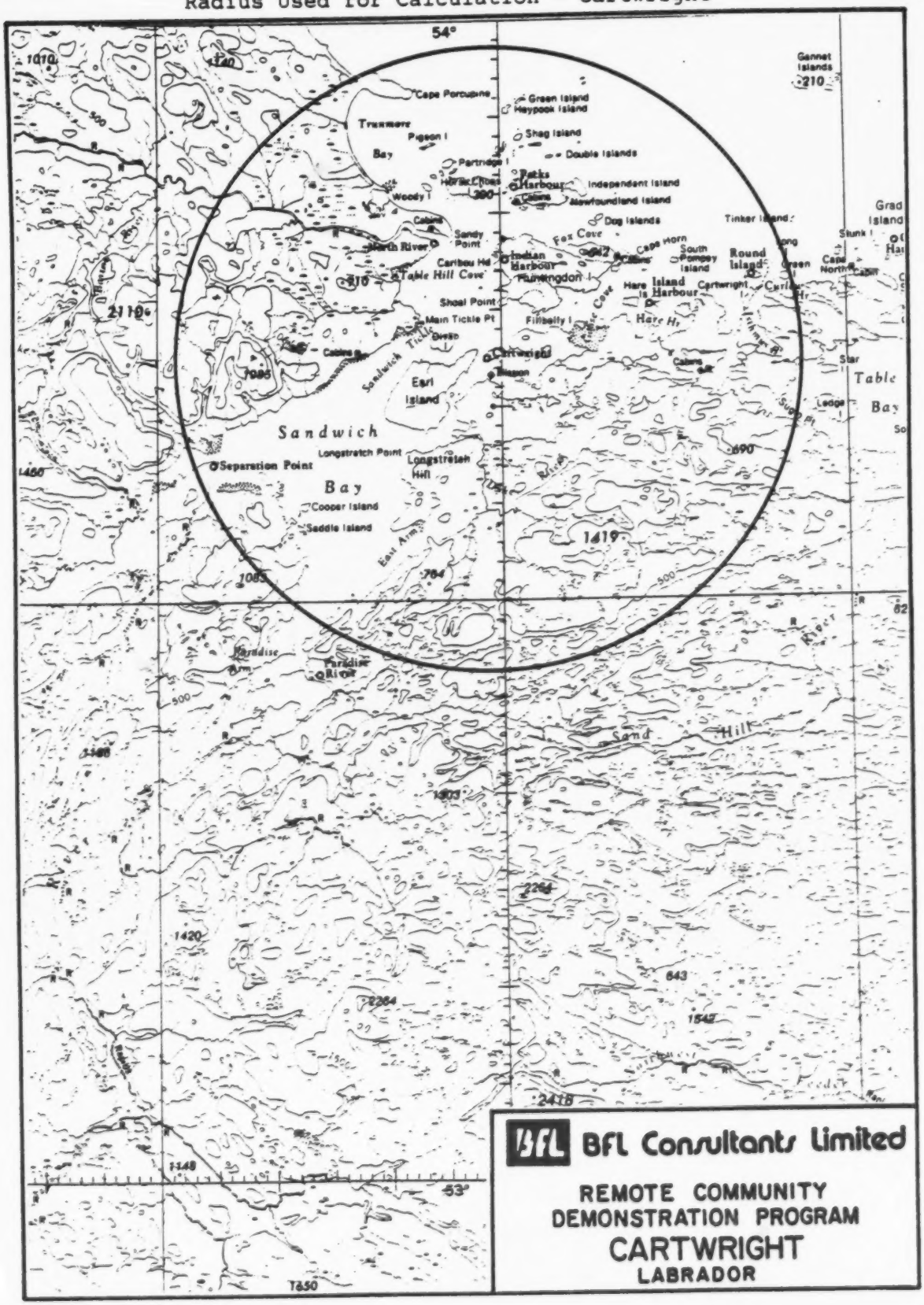
6. Sustainable Yield Volume: 18,649 cu.m./yr.
7. Residential Fuelwood Requirements Determination

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Cartwright	100	165	80	80	1,057,444	2,171

8. Estimated Sustainable Increase: 758.9%

The 30 km radius envelope used for Cartwright as part of this analysis is shown graphically in Figure 4.6

Figure 4.6
Radius Used for Calculation - Cartwright



4.2.2 Estimated Sustainable Increase - Mud Lake

Sustainable Yield Calculation
Reference Community - Mud Lake

1. Accessible Area: 26,700 hectares

2. Allowable Annual Cut: 381 hectares

3. Percent Unsuited Area: 3.6

4. Suitable Area: 25,739 hectares

5.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	56.2	127.1
Balsam Fir	43.3	134.9
White Birch	0.5	148.2

6. Sustainable Yield Volume: 49,808 cu.m./yr.

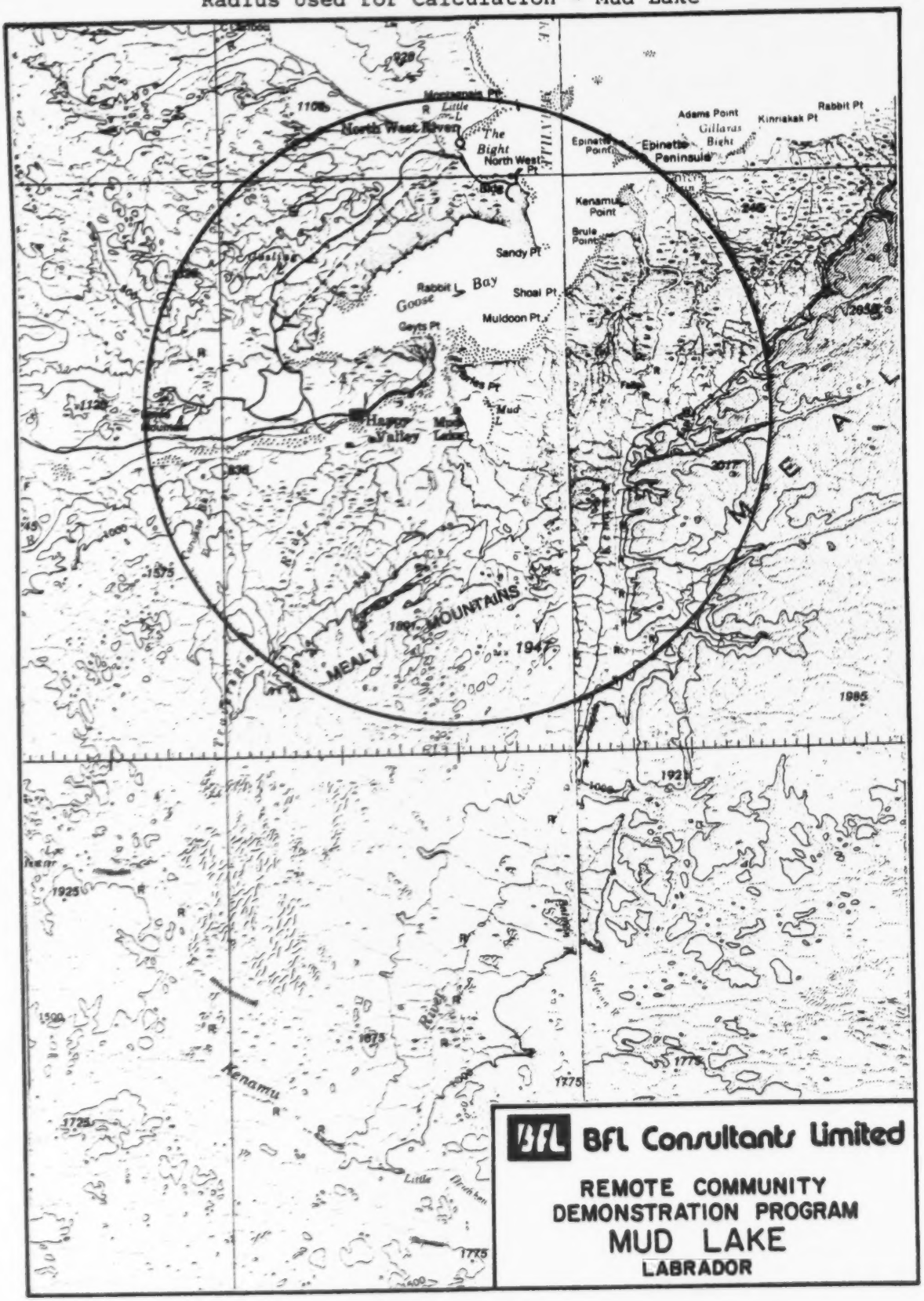
7. Residential Fuelwood Requirements Determination

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Mud Lake	100	25	100	100	250,342	514

8. Estimated Sustainable Increase: 9589.4%

The 30 km radius envelope used for Mud Lake as part of this analysis is shown graphically in Figure 4.7.

Figure 4.7
Radius Used for Calculation - Mud Lake



4.2.3 Estimated Sustainable Increase - Black Tickle

Sustainable Yield Calculation
Reference Community - Black Tickle

1. Accessible Area: 1,500 hectares

2. Allowable Annual Cut: 21 hectares

3. Percent Unsuited Area: 0.0

4. Suitable Area: 1,500 hectares

5.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	80.0	46.3
Balsam Fir	20.0	47.9
White Birch	0.0	0.0

6. Sustainable Yield Volume: 999 cu.m./yr.

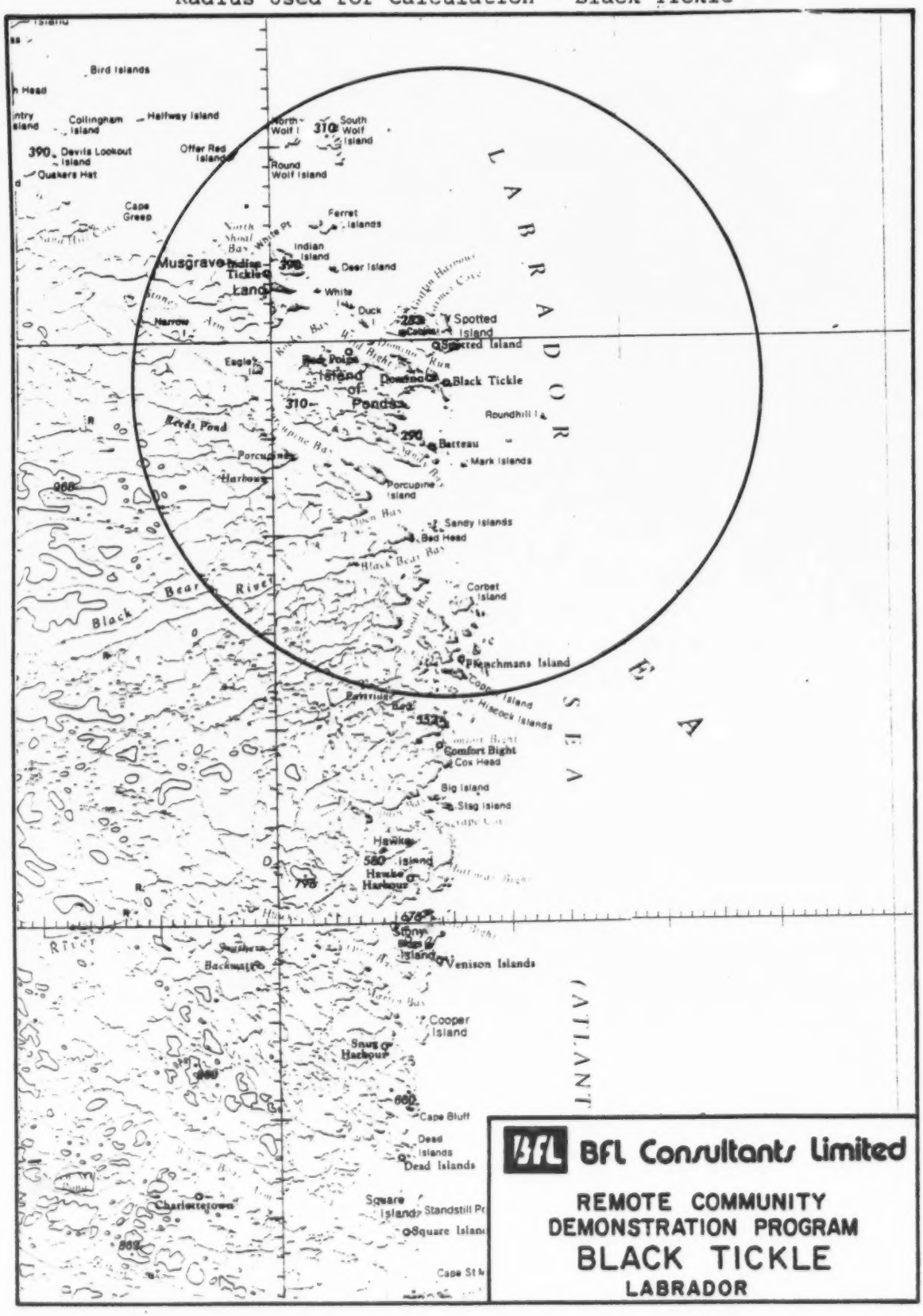
7. Residential Fuelwood Requirements Determination

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Black Tickle	100	100	50	50	250,342	514

8. Estimated Sustainable Increase: 94.3%

The 30 km radius envelope used for Black Tickle as part of this analysis is shown graphically in Figure 4.8.

Figure 4.8
Radius Used for Calculation - Black Tickle



4.2.4 Estimated Sustainable Increase - Postville

Sustainable Yield Calculation
Reference Community - Postville

1. Accessible Area: 6,800 hectares

2. Allowable Annual Cut: 97 hectares

3. Percent Unsuited Area: 17.5

4. Suitable Area: 5,610 hectares

5.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	76.6	75.0
Balsam Fir	23.4	94.2
White Birch	0.0	0.0

6. Sustainable Yield Volume: 7,722 cu.m./yr.

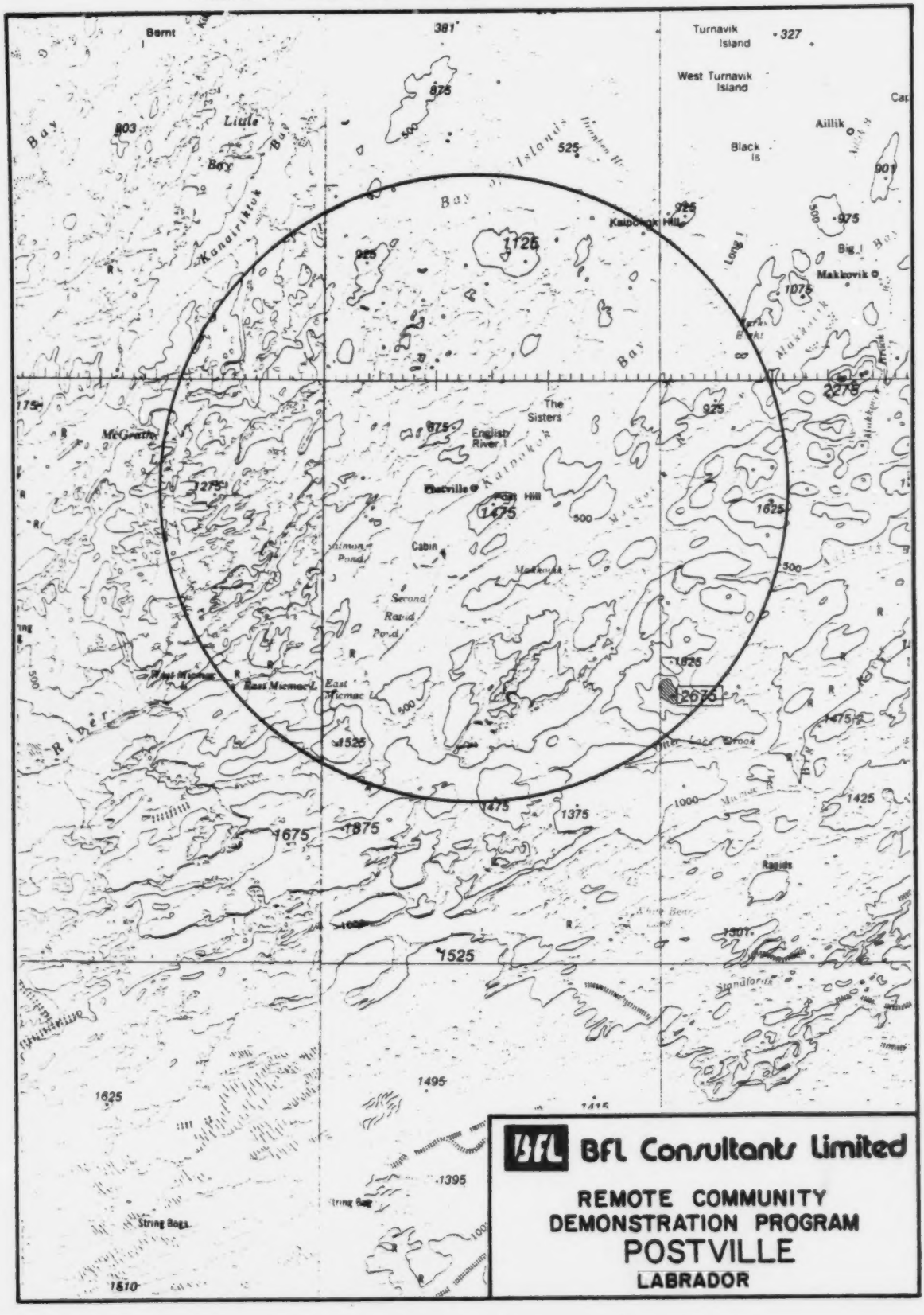
7. Residential Fuelwood Requirements Determination

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Postville	100	50	90	80	360,492	740

8. Estimated Sustainable Increase: 943.2%

The 30 km radius envelope used for Postville as part of this analysis is shown graphically in Figure 4.9.

Figure 4.9
Radius Used for Calculation - Postville



4.2.5 Estimated Sustainable Increase - Port Hope Simpson

Sustainable Yield Calculation
Reference Community - Port Hope Simpson

1. Accessible Area: 17,800 hectares

2. Allowable Annual Cut: 254 hectares

3. Percent Unsuited Area: 36.6

4. Suitable Area: 11,285 hectares

5.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	68.0	85.8
Balsam Fir	28.9	111.0
White Birch	3.1	77.5

6. Sustainable Yield Volume: 23,604 cu.m./yr.

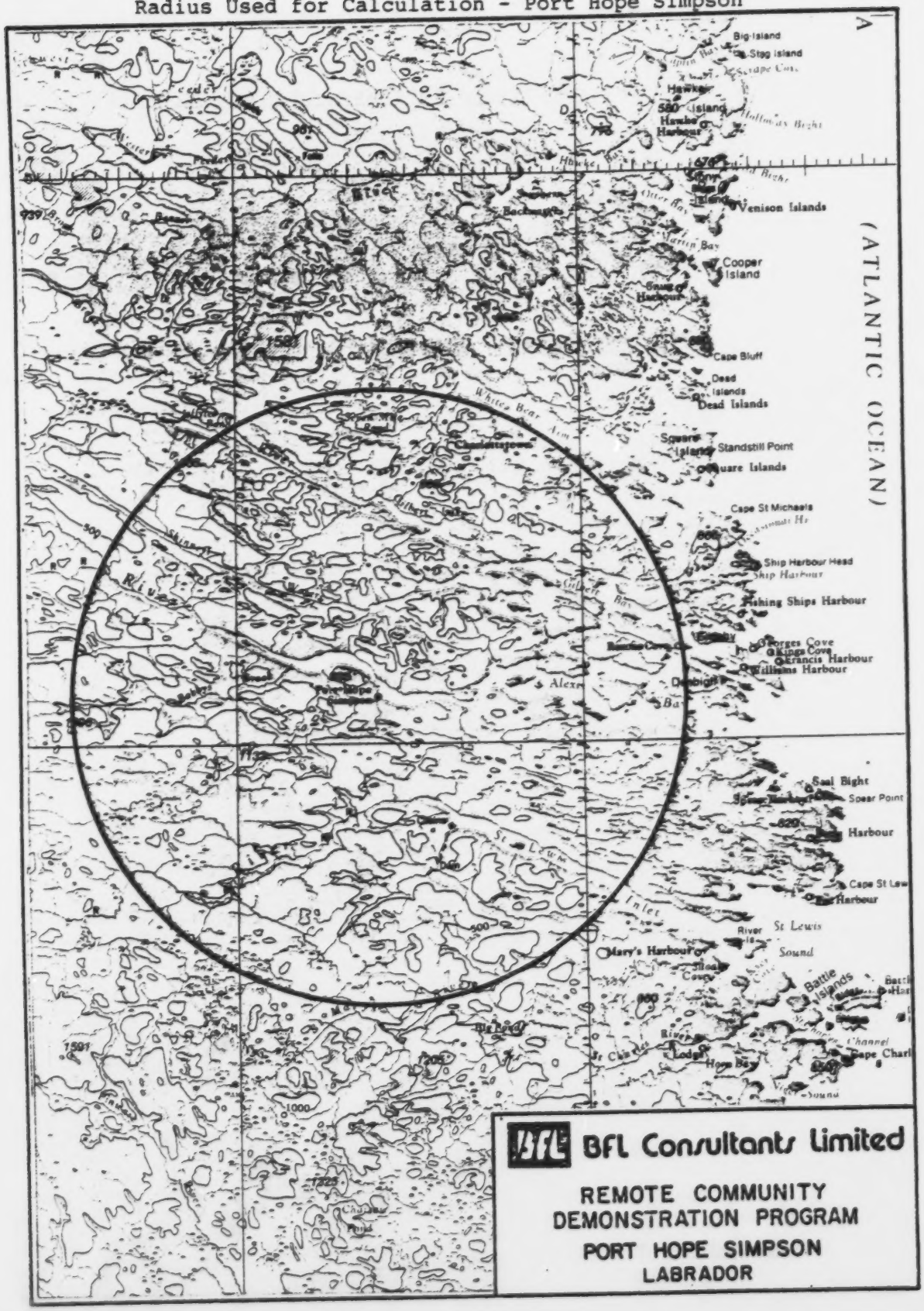
7. Residential Fuelwood Requirements Determination

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Port Hope Simpson	100	105	75	75	567,775	1,166

8. Estimated Sustainable Increase: 1924.6%

The 30 km radius envelope used for Port Hope Simpson as part of this analysis is shown graphically in Figure 4.10.

Figure 4.10
Radius Used for Calculation - Port Hope Simpson



4.2.6 Estimated Sustainable Increase - Harbour Deep

Sustainable Yield Calculation
Reference Community - Harbour Deep

1.

Age Class	Area (Hectare)
0-20	25
21-40	116
41-60	76
61-80	622
+81	2073
Total	2912

2. Weighted Average Age: 81.61

3. Average Normal Age: 35.00

4. Ratio of Weighted Age to Normal Age: 2.33

5. Allowable Cut for Initial 20 Years: 97 hectares

6. Allowable Balanced Cut: 42 hectares

7. Accessible Area: 2,900 hectares

8. Percent Unsuitable Area: 5.0

9. Suitable Area: 2,766 hectares

10.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	26.9	61.0
Balsam Fir	58.1	76.0
White Birch	15.0	22.0

11. Yield Volume for Initial 20 Years: 6,195 cu.m./yr.

12. Sustainable Yield Volume: 2,657 cu.m./yr.

13.

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Great Hbr. Deep	100	65	89	62.7	363,216	746
Englee	8	235/300	89	62.7	105,053	216/962

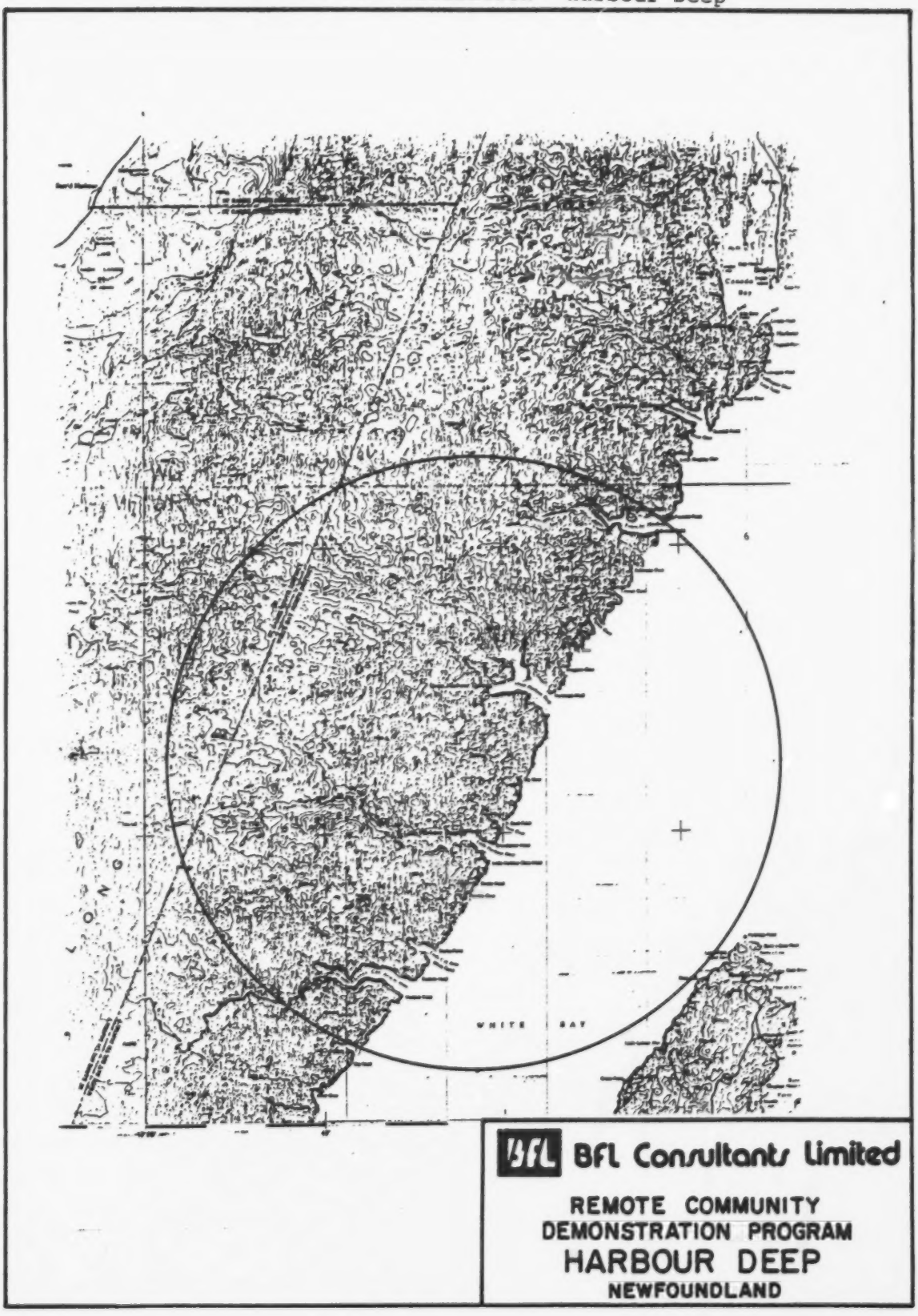
14. Allowable Annual Cut: 42 hectares

15. Allowable Volume Cut: 2,682 cu.m.

16. Estimated Sustainable Increase: 179.0%

The 30 km radius envelope used for Harbour Deep as part of this analysis is shown graphically in Figure 4.11.

Figure 4.11
Radius Used for Calculation - Harbour Deep



4.2.7 Estimated Sustainable Increase - Roddickton

Sustainable Yield Calculation
Reference Community - Englee

1.

Age Class	Area (Hectare)
0-20	375
21-40	886
41-60	1275
61-80	823
+81	3847
Total	7206

2. Weighted Average Age: 69.10

3. Average Normal Age: 35.00

4. Ratio of Weighted Age to Normal Age: 1.97

5. Allowable Cut for Initial 20 Years: 203 hectares

6. Allowable Balanced Cut: 103 hectares

7. Accessible Area: 7200 hectares

8. Percent Unsuitable Area: 18.0

9. Suitable Area: 5909 hectares

10.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	17.1	77.0
Balsam Fir	82.9	94.0
White Birch	0.0	0.0

11. Yield Volume for Initial 20 Years: 18,513 c.u./yr.

12. Sustainable Yield Volume: 9,377 cu.m./yr.

13.

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Englee	100.0	235	77	68	1,232,143	2530
Roddickton	68.0	265	77	68	944,818	1940
Conche	53.0	110	77	68	305,676	628
Gt.Hbr.Deep	9.5	65	77	68	32,377	66
St. Julien	12.5	24	77	68	15,729	32
Main Brook	8.0	120	77	68	50,334	103
		819				5300

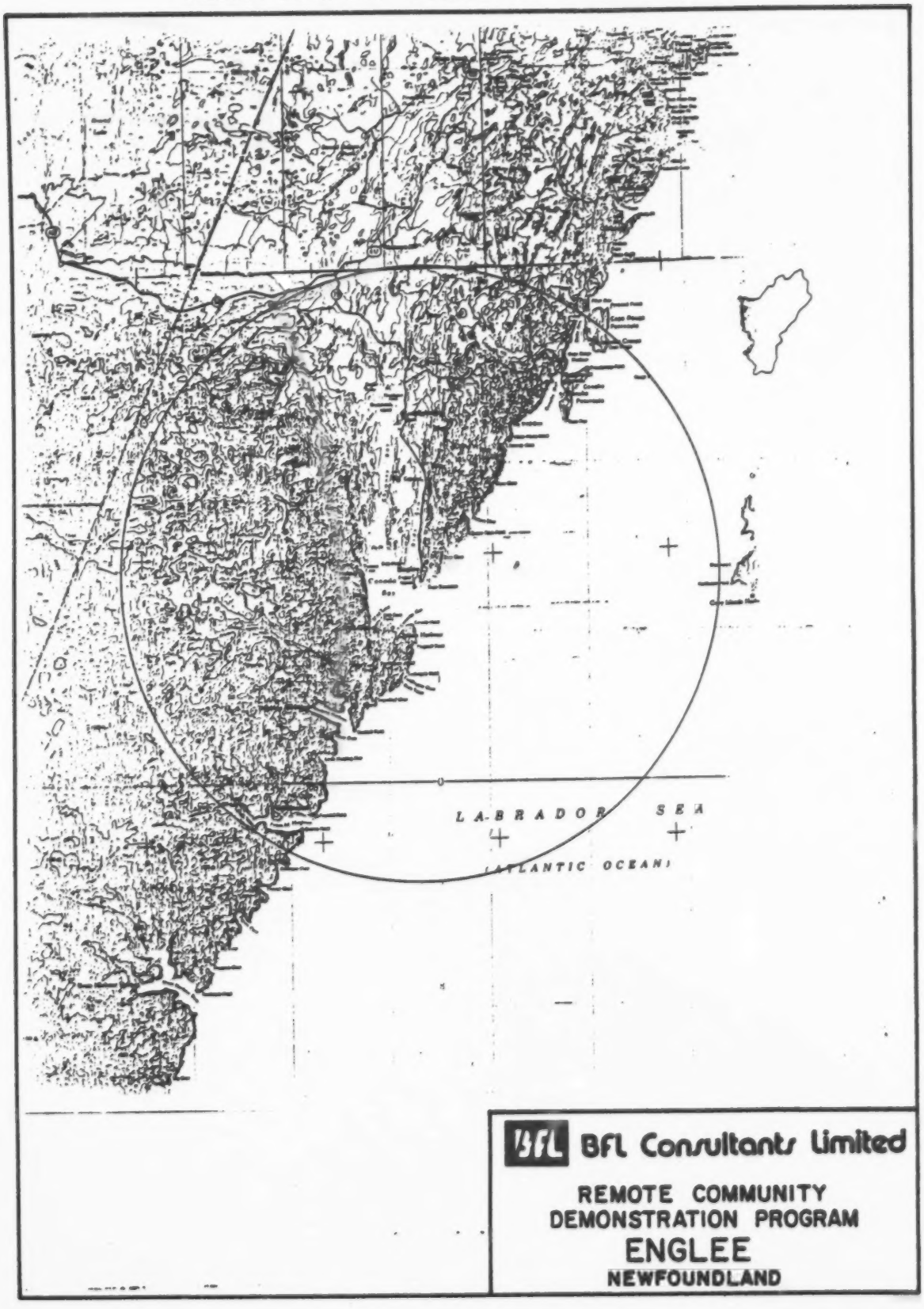
14. Allowable Annual Cut: 103 hectares

15. Allowable Volume Cut: 9383 cu.m./yr.

16. Estimated Sustainable Increase: 77.0%

The 30 km radius envelope used for Roddickton as part of this analysis is shown graphically in Figure 4.12.

Figure 4.12
Radius Used for Calculation - Roddickton



4.2.8 Estimated Sustainable Increase - St. Anthony

Sustainable Yield Calculation
Reference Community - St. Anthony

1.

Age Class	Area (Hectare)
0-20	492
21-40	510
41-60	980
61-80	1654
+81	2337
Total	5973

2. Weighted Average Age: 66.19

3. Average Normal Age: 35.00

4. Ratio of Weighted Age to Normal Age: 1.89

5. Allowable Cut for Initial 20 Years: 161 hectares

6. Allowable Balanced Cut: 85 hectares

7. Accessible Area: 6200 hectares

8. Percent Unsuitable Area: 14.9

9. Suitable Area: 5083 hectares

10.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	10.3	102.5
Balsam Fir	89.7	107.2
White Birch	0.0	0.0

11. Yield Volume for Initial 20 Years: 17,220 cu.m./yr.

12. Sustainable Yield Volume: 9,106 cu.m./yr.

13.

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Goose Cove	83	67	77	68	291,572	599
St. Julien	35	24	77	68	44,043	90
Main Brook	27	120	77	68	169,878	349
Conche	6	110	77	68	31,721	65
St.Ant.Bgt.	94	46	77	68	225,508	463
St.Carols	91	20	77	68	95,426	196
Gt.Brehat	81	26	77	68	110,421	227
St.Lunaire	62	115	77	68	373,837	768
Griquet	56	95	77	68	278,936	573
Quirpon	46	45	77	68	108,533	223
L.a.Mead.	42	14	77	68	30,830	63
Spill.Cv.	48	25	77	68	62,918	129
Ship Cv.	45	60	77	68	141,565	291
Raleigh	52	85	77	68	231,748	476
Cooks Hbr.	34	90	77	68	160,441	329
Wild Bgt.	31	12	77	68	19,505	40
N.Boat Hbr.	35	21	77	68	38,537	79
St. Ant.	100	790	47	50	1,873,911	3848
		1765				8808

14. Allowable Annual Cut: 85 hectares

15. Allowable Volume Cut: 9071 cu.m./yr.

16. Estimated Sustainable Increase: 2.99%

The 30 km radius envelope used for St. Anthony as part of this analysis is shown graphically in Figure 4.13.

Figure 4.13
Radius Used for Calculation - St. Anthony

4.2.9 Estimated Sustainable Increase - Fogo Island

Sustainable Yield Calculation
Reference Community - Fogo Island

1.

Age Class	Area (Hectare)
0-20	279
21-40	1376
41-60	1387
61-80	2922
+81	459
Total	6423

2. Weighted Average Age: 55.93

3. Average Normal Age: 35.00

4. Ratio of Weighted Age to Normal Age: 1.60

5. Allowable Cut for Initial 20 Years: 147 hectares

6. Allowable Balanced Cut: 92 hectares

7. Accessible Area: 6400 hectares

8. Percent Unsuitable Area: 26.0

9. Suitable Area: 4753 hectares

10.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	45.9	60.0
Balsam Fir	48.6	38.0
White Birch	5.5	63.0

11. Yield Volume for Initial 20 Years: 7255 cu.m./yr.

12. Sustainable Yield Volume: 4540 cu.m./yr.

13.

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Joe Batts	83.0	222	81	49.8	744,285	1528
Barr'd Is.	85.0	54	81	49.8	185,405	381
Tilting	68.5	110	81	49.8	304,363	625
Shoal Bay	85.5	17	81	49.8	58,711	121
Seldom	74.0	109	81	49.8	325,811	669
Lt.Seldom	70.5	21	81	49.8	59,802	123
Stag Hbr.	66.0	73	81	49.8	194,614	400
Island Hb.	76.0	66	81	49.8	202,612	416
Deep Bay	89.5	160	81	49.8	130,147	267
Change Is.	78.0	74	81	49.8	504,107	1035
Aspen Cv.	38.0	54	81	49.8	113,586	233
Ladle Cv.	37.0	415	81	49.8	80,706	166
Musgr. Hb.	27.0	55	81	49.8	452,605	929
Deadman B.	1.0	275	81	49.8	2,222	5
Carmanvll.	35.0	69	81	49.8	388,784	798
Noggin Cv.	33.5	102	81	49.8	93,369	192
Fredrickt.	33.5	70	81	49.8	138,023	283
Mann Pt.	21.0	45	81	49.8	59,378	122
Main Pt.	18.5	112	81	49.8	33,627	69
Gander B.S.	8.0	105	81	49.8	36,192	74
Clarkes Hd.	9.0	60	92	93.4	81,313	167
Wings Pt.	13.5	60	92	93.4	69,697	143
Victria Cv.	18.5	26	92	93.4	95,511	196
Rodgers Cv.	19.5	131	92	93.4	43,625	90
Horwood	32.0	33	92	93.4	360,703	741
Prt. Albert	45.5	102	92	93.4	129,197	265
Boyds Cv.	21.0	155	92	93.4	184,310	378
Birchy By.	6.0	48	92	93.4	80,022	164
Newstead	3.5	93	92	93.4	14,456	30
Comfort Cv.	3.5	300	92	93.4	28,008	58
Summerford	15.0	51	92	93.4	387,205	795
Cottles Is.	10.0	179	92	93.4	46,077	95
Virgin Arm	19.0	50	92	93.4	292,641	621
Carters Cv.	20.8	15	92	93.4	86,046	177
Tilt Cv.	36.5	58	92	93.4	47,110	97
Bridgeport	12.0	63	92	93.4	59,888	123
Moreton Hb.	32.0	54	92	93.4	81,313	167
Whales Gul.	37.5	38	92	93.4	55,757	114
Hillgrade	34.0	45	92	93.4	104,631	215
Newville	28.5	45	92	93.4	145,202	299

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Bl.Duck Cv.	34.0	45	68	33.7	35,109	72
Bluff Hd.Cv.	28.5	47	68	33.7	30,738	63
Little Hbr.	32.0	98	92	93.4	269,839	554
Cobbs Arm	41.0	50	92	93.4	223,718	459
Sunnyside	46.5	16	92	93.4	64,018	131
Salt Hbr.	48.0	31	92	93.4	128,036	263
Twillingt.	29.5	430	68	33.7	291,087	598
Durrell	33.0	335	68	33.7	253,683	521
Cow Head	25.5	100	68	33.7	58,516	170
Fogo	100.0	265	81	49.8	1,070,419	2198
		5222				18329

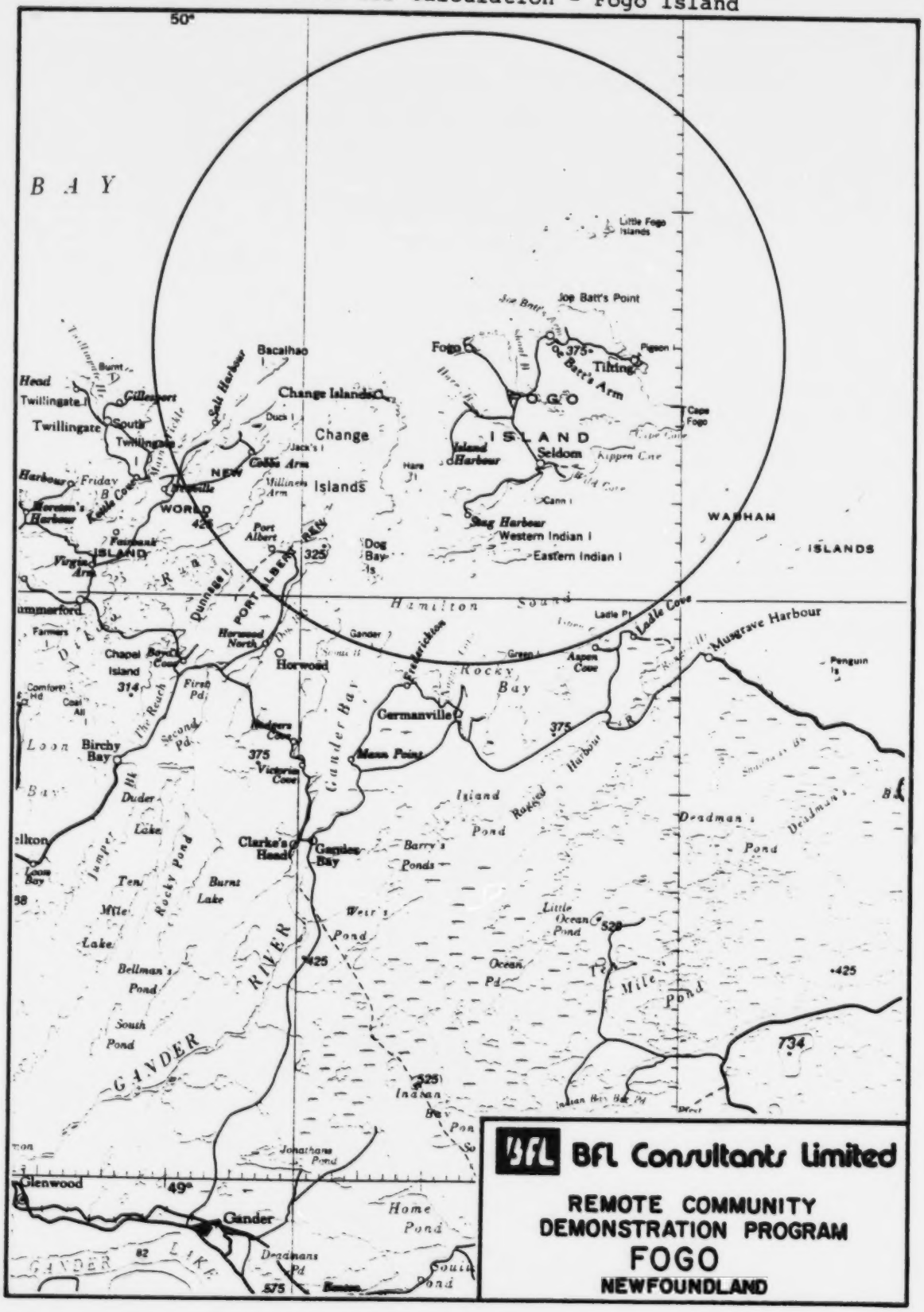
14. Allowable Annual Cut: 90 hectares

15. Allowable Volume Cut: 4453 c.u./yr.

16. Estimated Sustainable Increase: (-75.7%)

The 30 km radius envelope used for Fogo Island as part of this analysis is shown graphically in Figure 4.14.

Figure 4.14
Radius Used for Calculation - Fogo Island



4.2.10 Estimated Sustainable Increase - Little Bay Islands

Sustainable Yield Calculation
Reference Community - Little Bay Islands

1.

Age Class	Area (Hectare)
0-20	4416
21-40	1171
41-60	7267
61-80	22515
+81	4343
Total	

2. Weighted Average Age: 60.68

3. Average Normal Age: 35.00

4. Ratio of Weighted Age to Normal Age: 1.73

5. Allowable Cut for Initial 20 Years: 983 hectares

6. Allowable Balanced Cut: 567 hectares

7. Accessible Area: 39,700 hectares

8. Percent Unsuitable Area: 14.0

9. Suitable Area: 34,152 hectares

10.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	49.5	78.3
Balsam Fir	35.2	100.3
White Birch	11.9	75.6
Trembling Aspen	3.4	279.1

11. Yield Volume for Initial 20 Years: 91,022 cu.m./yr.

12. Sustainable Yield Volume: 52,505 cu.m./yr.

13.

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Lt. Bay Is.	100.0	115	85	51.7	506,059	1039
Beaumont	81.0	76	85	51.7	278,024	571
Lushes Bgt.	83.0	37	85	51.7	135,140	277
Miles Cv.	77.0	50	85	51.7	169,420	348
Pilleys Cv.	67.0	130	85	51.7	383,284	787
Brighton	66.0	70	85	51.7	203,304	417
Triton	60.0	290	85	51.7	765,689	1572
L.Tick.W.	40.5	102	92	83.1	316,255	649
L.Tick.S.	39.0	43	92	83.1	128,385	264
Cottrell C.	20.5	93	92	83.1	145,955	300
Fortune Hb.	18.5	38	92	83.1	53,819	111
Paradise	13.5	21	92	83.1	21,704	45
P. Leamgtn.	15.0	220	92	83.1	252,637	519
Pt. of Bay	0.5	50	92	83.1	1,914	4
Phillips H.	1.0	57	92	83.1	4,364	9
Port Anson	75.0	40	85	51.7	132,015	271
Roberts Arm	64.0	245	85	51.7	690,000	1417
South Brook	33.5	200	85	51.7	294,834	605
Springdale	48.0	920	85	51.7	1,943,265	3990
St. Pats	77.0	7	85	51.7	23,719	49
Little Bay	75.0	80	85	51.7	264,031	542
Wild Bight	84.5	60	85	51.7	223,106	458
Harrys Hb.	77.0	58	85	51.7	196,527	404
Nickey N.C.	75.0	7	85	51.7	23,103	47
Langdons C.	70.0	16	85	51.7	49,286	101
Jacksons C.	68.0	29	85	51.7	86,778	178
Kings Pt.	42.0	200	85	51.7	369,643	759
Rattling B.	35.5	38	92	83.1	103,275	212
Middle Arm	54.0	125	85	51.7	297,034	610
Burlington	58.5	90	85	51.7	231,687	476
Smiths Hb.	64.0	23	85	51.7	64,776	133
Nippers Hb.	64.0	65	85	51.7	183,061	376
Snooks Arm	48.0	9	85	51.7	19,010	39
Round Hb.	48.0	9	85	51.7	19,010	39
Tilt Cv.	40.0	15	85	51.7	26,403	54
Shoe Cv.	30.0	57	85	51.7	75,249	155
La Scie	26.0	345	85	51.7	394,726	811
Brents Cv.	34.0	60	85	51.7	89,770	184
Hb. Round	37.5	58	85	51.7	95,711	197
Woodstock	28.5	85	85	51.7	106,602	219
Pacquet	22.0	95	85	51.7	91,971	189
South Brk.	21.5	200	85	51.7	189,222	389
Mings Bgt.	20.0	90	85	51.7	79,209	163
		4620				19977

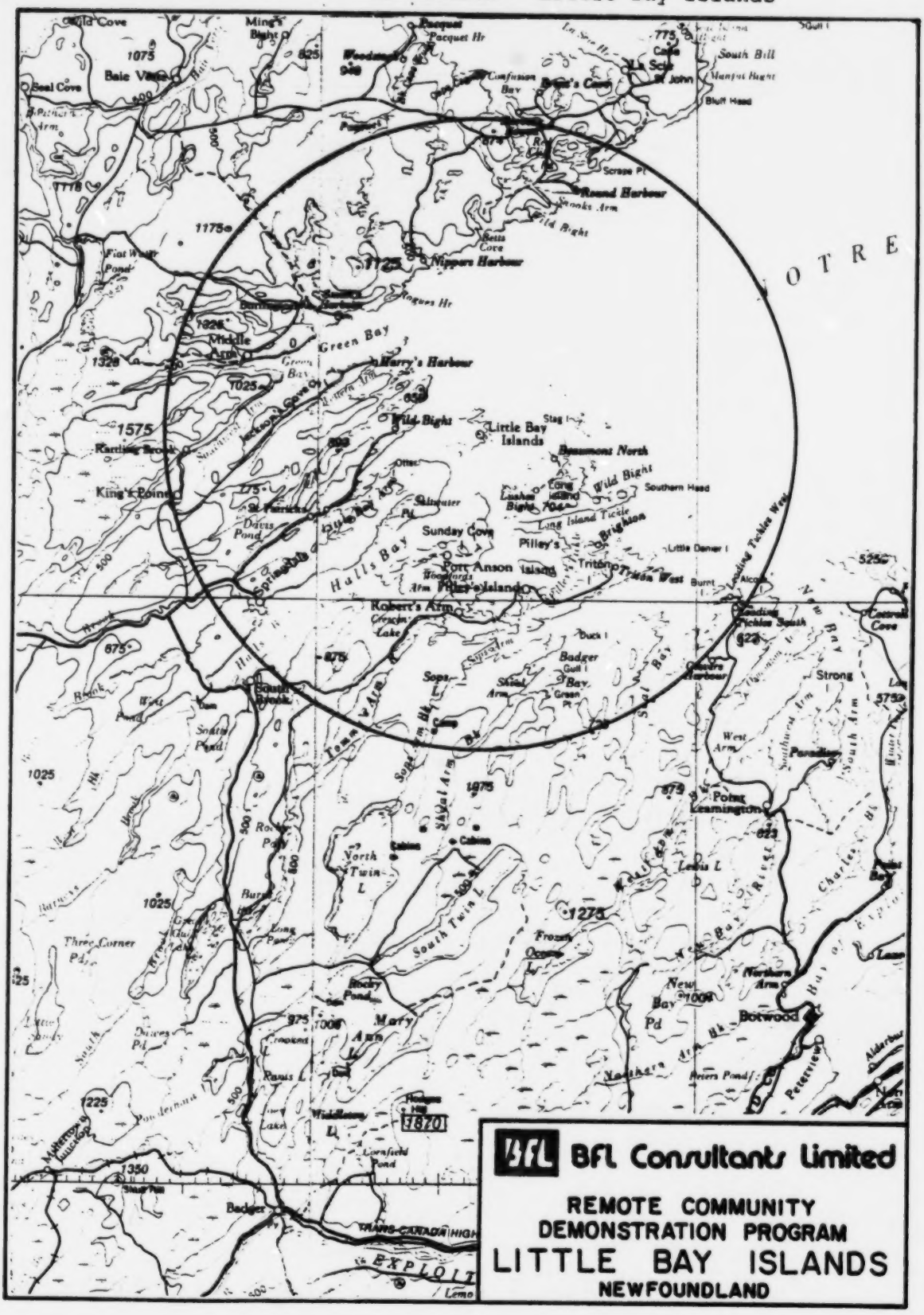
14. Allowable Annual Cut: 567 hectares

15. Allowable Volume Cut: 52,476 cu.m./yr.

16. Estimated Sustainable Increase: 162.7%

The 30 km radius envelope used for Little Bay Islands as part of this analysis is shown graphically in Figure 4.15.

Figure 4.15
Radius Used for Calculation - Little Bay Islands



4.2.11 Estimated Sustainable Increase - St. Brendans

Sustainable Yield Calculation
Reference Community - St. Brendans

1.

Age Class	Area (Hectare)
0-20	6698
21-40	957
41-60	2272
61-80	9120
+81	718
Total	19765

2. Weighted Average Age: 46.16

3. Average Normal Age: 35.00

4. Ratio of Weighted Age to Normal Age: 1.32

5. Allowable Cut for Initial 20 Years: 372 hectares

6. Allowable Balanced Cut: 282 hectares

7. Accessible Area: 19,600 hectares

8. Percent Unsuitable Area: 39.0

9. Suitable Area: 12,057 hectares

10.

Species	% Suitable Area	Yield (cu.m./ha.)
Black Spruce	80.7	89.0
Balsam Fir	11.3	98.0
White Birch	8.0	73.0

11. Yield Volume for Initial 20 Years: 33,043 cu.m./yr.

12. Sustainable Yield Volume: 25,056 cu.m./yr.

13.

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
St. Brend.	100.0	37	81	49.8	147,155	302
Deadman By.	3.5	55	81	49.8	7,656	16
Lumsden	10.5	165	81	49.8	68,905	141
Cp. Freels	15.0	25	81	49.8	14,914	31
Newtown	23.0	145	81	49.8	132,639	272
Wesleyville	35.5	330	55	18.6	118,162	243
Valleyfld.	37.5	126	55	18.6	47,658	98
Badger Quay	40.5	175	55	18.6	71,487	147
Pools Is.	43.5	61	55	18.6	26,764	55
Greenspond	51.0	115	55	18.6	59,157	121
Centreville	53.0	135	81	49.8	284,567	584
Trinity	50.0	44	87	60.6	114,360	235
Dover	52.0	195	81	49.8	403,285	828
Hare Bay	45.5	355	81	49.8	642,413	1319
Middle Bk.	20.0	255	81	49.8	202,836	417
Dark Cv.	18.5	316	81	49.8	232,506	477
Gambo	15.5	113	81	49.8	69,660	143
Glovertown	29.5	610	55	18.6	181,505	373
Traytown	35.5	110	81	49.8	155,309	319
Sandringham	48.0	65	81	49.8	124,088	299
St. Chaps	56.0	32	81	49.8	71,271	146
Burnside	59.0	40	81	49.8	93,861	193
Eastport	48.0	190	55	18.6	91,988	189
Hpy. Adven.	45.5	100	81	49.8	180,961	372
Sandy Cv.	47.0	60	81	49.8	112,156	230
Salvage	58.5	55	81	49.8	127,966	263
Shallwy.Cv.	94.0	35	81	49.8	130,849	269
Dock Cv.	97.0	20	81	49.8	77,157	158
Tickle Cv.	32.0	21	87	60.6	34,932	72
Red Cliff	28.0	17	77	43.6	15,756	32
Open Hall	26.0	26	77	43.6	22,376	46
Plate Cv.E.	20.5	45	77	43.6	30,539	63
Plate Cv.W.	20.0	60	77	43.6	39,721	82
Keels	31.5	35	87	60.6	57,310	118
Duntara	28.0	35	77	43.6	32,439	67
Kings Cv.	20.5	70	77	43.6	47,500	98
Stock Cv.	17.0	18	87	60.6	15,906	33
Knights Cv.	16.0	29	77	43.6	15,359	32
U.Amherst C.	12.5	21	57	22.8	3,364	7
Amherst Cv.	12.5	39	57	22.8	6,247	13
Newmans Cv.	12.0	66	57	22.8	10,148	21
Birchy Cv.	12.5	10	57	22.8	1,602	3
Bonavista	13.0	1245	57	22.8	207,388	426
Summerville	12.0	93	77	43.6	36,940	76

Community	% Envel. Overlap	Total Dwell.	% Wood Burn. Dwell.	% Heat Derived 1983	Wgt. Required kg./yr.	From Envel. cu.m.
Princeton	8.0	55	77	43.6	14,564	30
Sweet Bay	12.0	55	77	43.6	21,846	45
Southern B.	5.5	55	57	22.8	3,876	8
Charleston	5.0	44	87	60.6	11,436	23
Winter Bk.	9.0	27	87	60.6	12,632	26
Jamestown	10.0	39	87	60.6	20,273	42
Portland	8.0	29	87	60.6	12,060	25
Brooklyn	7.0	52	87	60.6	18,921	39
Lethbrdge	1.0	180	87	60.6	9,357	19
Bloomfield	1.5	188	77	43.6	9,334	19
Musgravetown	4.0	185	57	22.8	9,482	19
Canning Cv.	9.0	93	57	22.8	10,725	22
Bunyans Cv.	0.5	155	77	43.6	2,565	5
Charlottetn.	3.0	87	81	49.8	10,380	21
Culls Hb.	58.5	29	81	49.8	67,473	139
		7067				9884

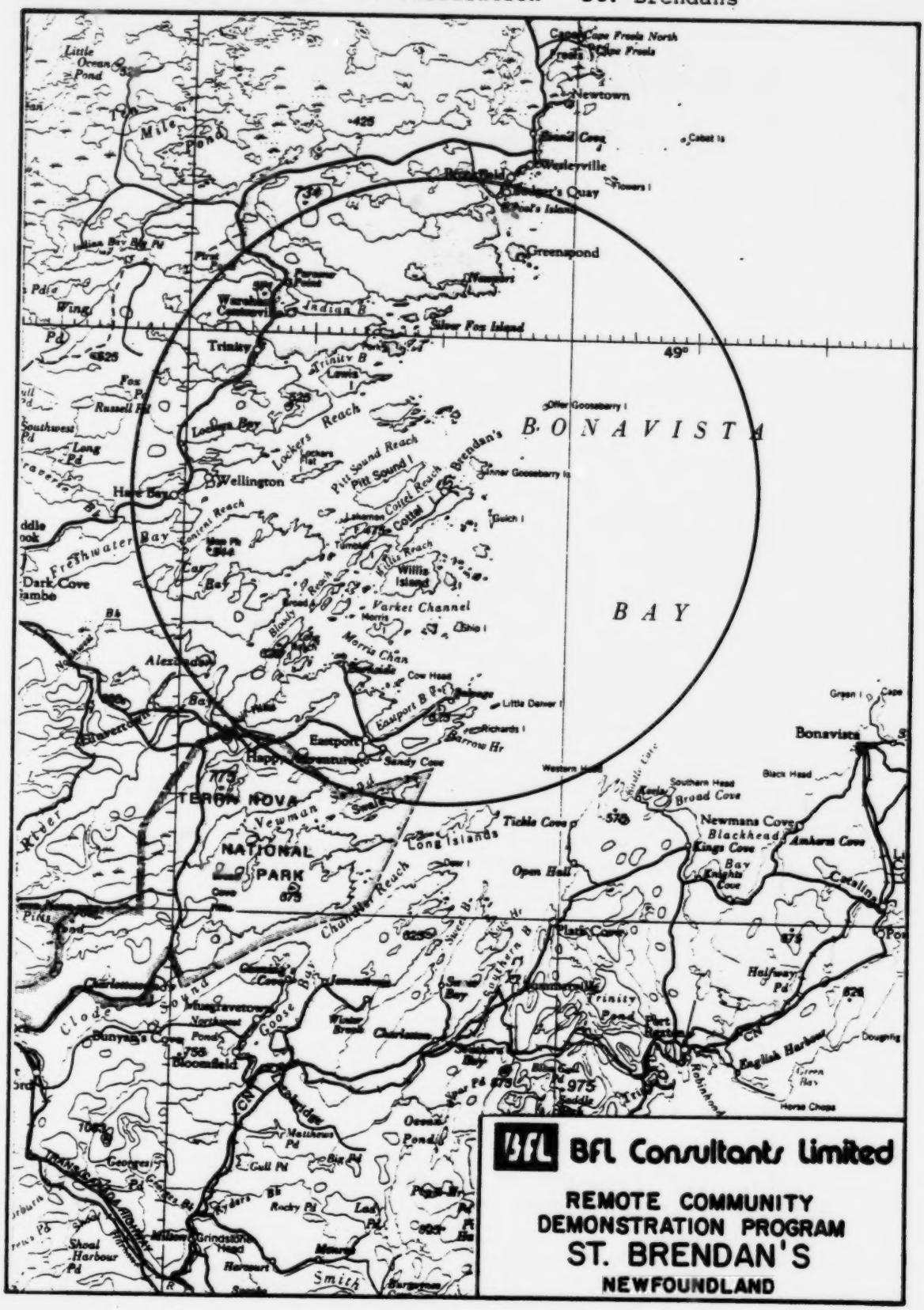
14. Allowable Annual Cut: 282 hectares

15. Allowable Volume Cut: 25,024 cu.m./yr.

16. Estimated Sustainable Increase: 153.7%

The 30 km radius envelope used for St. Brendans as part of this analysis is shown graphically in Figure 4.16.

Figure 4.16
Radius Used for Calculation - St. Brendans



4.3 Potential for Fuelwood Substitution .

The potential for fuelwood substitution in remote communities could not be examined for all locations owing to a lack of fuelwood inventory information, and because the survey results available from this study are only valid at a regional level. These limitations notwithstanding, there are a number of general comments which can be made about fuelwood substitution potential.

As referenced in section 4.1, the Department of Forest Resources and Lands undertakes mapping programs for the principal purpose of developing an inventory of potentially commercial timber stands. Apart from obvious budget limitations, areas are excluded when it is judged they do not likely contain any commercial stands, are non-commercial at the present time, or do not have any substantial forest resources. This latter point appears valid for the southwest coast of Newfoundland.

Given these basic facts, the load centres for which inventory information is available are presented in Table 4.1. For each load centre, the estimated annual sustainable percentage increase in fuelwood usage is summarized.

Table 4.1: Estimated Annual Sustainable Percentage Increase in Fuelwood Usage by Load Centre

Load Centre	Estimated Sustainable Increase in Fuelwood Usage - % Change
Cartwright	759%
Mud Lake	9589%
Black Tickle	94%
Postville	943%
Port Hope Simpson	1925%
Harbour Deep	179%
Roddickton	77%
St. Anthony	3%
Fogo Island	-76%
Little Bay Islands	163%
St. Brendans	154%

As is evident from the above table, only one load centre, i.e. Fogo Island, appears to be seriously overtaxing the resource base available. While St. Anthony is also

approaching the limits of increased usage of the resource base, the other nine load centres have more than adequate fuelwood to satisfy present fuelwood consumption patterns.

While it is not possible to draw direct comparisons between the information presented in Table 4.1 and the survey results, several points are worth noting. Five of the eleven load centres for which inventory information was available are in Labrador, and the survey results showed that the Labrador region had the highest percentage of respondents who reported using wood as a principal heating fuel, i.e. 64%. Of the six remaining load centres for which inventory information is available, three are located in the Northern region and three are in the Central region. Readers will recall that 56% and 62% respectively of respondents in these two areas reported using wood as their principal heating fuel. For the area where no inventory information is available, i.e. the Southern region as defined by the survey, only 29% of respondents reported using wood as their main heating fuel.

From the information presented above it is suggested that there is a strong association between areas which have been mapped, and therefore contain timber stands of some significance, and the results of the survey, which show that people in regions where mapping has been completed use wood extensively for their main heating requirements.

In terms of attempting to make a judgement about the overall potential for fuelwood substitution, the available information makes definitive statements impossible. All that can be said is that for those communities for which inventory information is available, the majority of load centres, except Fogo Island and perhaps St. Anthony, could sustain substantial increases in the use of the fuelwood resource base.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The major conclusions and recommendations stemming from this report are outlined below.

1. Conclusions and Recommendations: Housing Characteristics

With respect to regional housing characteristics, the results show that 92% of respondents own their place of residence. The majority of dwellings are single detached properties,i.e. 93%. Bungalows constitute 67% of the housing types in the study and two-storeys contribute a further 26%. Seventy-three percent of the housing stock was built after 1950. This information clearly implies that any initiatives undertaken by EMR in remote communities should be directed towards owner-occupied single detached bungalows or two-storeys built after 1950.

2. Conclusions and Recommendations: Socio-Economic Characteristics

An assessment of the socio-economic characteristics of survey respondents indicates the following general conclusions. With the exception of Labrador, where 71% of respondents were male, the general breakdown of 55% male and 45% female is typical of remote communities. The majority of respondents, i.e. 59%, are in age groups 25-34 and 35-44. A large group of individuals are between the ages of 45 and 65, i.e. 28%. Clearly, any initiative undertaken, regardless of region, will have to accommodate the diversity of ages encountered in remote communities. The education level of respondents, regardless of region, is generally low. Some 43% of respondents have only completed grade eight or less. A further 44%, however, have either some high school or vocational school, or completed high school or vocational school. Clearly, the discrepancy between those with limited schooling and those with advanced education will have to be considered when planning initiatives in any of the regions. A majority of respondents, again regardless of region, have total household income levels which are quite low. Some 56% of respondents reported a total household income of less than $16,000. Clearly, attempts to encourage respondents in remote communities to invest in energy conservation actions will have to take into consideration the limited incomes available in these areas.

3. Conclusions and Recommendations: Energy Consumption Characteristics

The majority of respondents in remote communities reported using wood as the main heating source. This is especially true for Labrador, where 64% of respondents reported using wood as the main heating fuel. The Northern and Central regions were 56% and 62% respectively. The Southern region was the exception with only 29% of respondents using wood as the principal heating fuel. It is also important to note that a large percentage of respondents, i.e. 93%, do not use any form of supplementary heating. These above statements, plus the fact that 91% of respondents who reported using wood as their principal heating source cut their own supply, and do so within 20 miles of their homes, suggest that wood is being extensively exploited and relied upon heavily when it is available. These conclusions have important implications for both the potential for energy conservation and fuelwood substitution, especially in the Labrador, Northern and Central regions. Specifically, because a majority of respondents in these areas are burning wood and cutting it themselves within close proximity to their homes, and therefore are paying very little for their energy requirements, it may be difficult to convince individuals in these areas to invest in energy conservation activities. With respect to fuelwood substitution potential, the above conclusions also suggest a saturation point may have already occurred in these regions. The basic recommendation is that EMR will have to be cautious in its approach to promoting either energy conservation or fuelwood substitution in the Labrador, Northern or Central regions, as very little incentive apparently exists to invest in energy conservation initiatives, and fuelwood usage may have hit the saturation level.

4. Conclusions and Recommendations: Energy Conservation Potential

The overall potential for energy conservation in the four regions is 72%. This varies regionally in the following way: Labrador - 72%; Northern - 70%; Central - 73%; and Southern - 71%. Clearly, there is little difference between the regions in terms of conservation potential. The analysis of conservation potential leads to the further conclusion that regardless of region the potential for heat loss reduction is through improvement to the ground floor and attic areas. Given these basic conclusions it would be reasonable to assume that conservation initiatives should be directed towards the region where the maximum energy and dollar savings could be derived. If this suggestion were adopted, then Labrador would be the area chosen, as it has the highest estimated annual energy savings at 186 million

BTU's per household, and the highest estimated annual dollar savings at $1072 per household. If not Labrador, then the next logical choice would appear to be the Northern region, where the estimated annual energy savings per household is 128 million BTU's, and the estimated annual dollar savings per household is $858. The next logical region would be the Central area, where the corresponding values are 131 million BTU's and $830 respectively. The final region would be the Southern area, where the corresponding values are 96 million BTU's and $839. The higher-than-expected dollar savings in the Southern region reflects the fact that oil is a more expensive commodity than wood. Before recommending that EMR automatically select the Labrador region for any program initiatives, the comments made in 3 above should be considered. If, however, EMR can find a community in Labrador that has the same basic characteristics as reported by this survey - with the major exception that the principal heating source be oil and not wood - then this region should be selected. The same principle would apply to the Northern and Central regions. Should, however, a community not be found in either the Labrador, Northern or Central regions which meets the above suggestion, then EMR should consider the Southern region. With the exception of Labrador, the dollar savings are similar to the other areas, and given that for respondents living in this region the savings would be more meaningful because they have no choice but to purchase their energy requirements, it would probably be easier to convince these people to invest in energy conservation actions.

5. Conclusions and Recommendations: Fuelwood Substitution Potential

The potential for fuelwood substitution is remote communities could only be estimated for eleven load centres encompassing 37 communities. These 37 communities represent 48% of the total eligible communities under the RCDP Program. For the majority of the load centres for which information was available, the estimated annual sustainable percentage increase in fuelwood usage is so high that no problems are anticipated in being able to sustain or increase fuelwood consumption. For the Fogo Island load centre, however, actions which could reduce fuelwood usage in this area should be encouraged. The information for the eleven load centres analyzed in the study is presented below.

Load Centre	Estimated Annual Sustainable Increase in Fuelwood Usage % Change
Cartwright	759%
Mud Lake	9589%
Black Tickle	94%
Postville	943%
Port Hope Simpson	1925%
Harbour Deep	179%
Roddickton	77%
St. Anthony	3%
Fogo Island	-76%
Little Bay Islands	163%
St. Brendans	154%